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ABSTRACT

The potential for the electronic delivery of educational services to the handicapped child is great. The handicapped comprise 10% of the student population and include a variety of smaller subgroups; less than half of these students currently receive special education. Special education is generally labor intensive and often involves a team approach and inter-district cooperation. The development of electronic systems for the delivery of instructional services to the handicapped appears to be worthwhile pursuit, for it would allow educations to design discrete units with clear behavioral objectives, to create a pace instruction to the individual's needs, permit the on-site delivery of multi-sensory messages to dispersed populations and provide educators with nearly instantaneous means of communication. A network for the production and distribution of instructional materials for the handicapped is developing under the auspices of the National Center on Educational Media and Materials for the Handicapped. However, additional funding and research is still necessary, and it must be recognized that in the future special education will remain labor intensive and that the role of the electronic delivery of instruction will be defined somewhat by the nature of the individual's handicap. (Author/PB)

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EDUCATION OF THE HANDICAPPED CHILD: STATUS, TRENDS, AND ISSUES RELATED TO ELECTRONIC DELIVERY

DONNA ROTHENBERG

ER 000 089

WASHINGTON UNIVERSITY / ST. LOUIS / MISSOURI 63130

ED 086235

CENTER FOR DEVELOPMENT TECHNOLOGY
(Communications Group)

WASHINGTON UNIVERSITY

Memorandum No. 73/4 December, 1973

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DONNA ROTHENBERG

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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SUMMARY: EDUCATION OF THE HANDICAPPED: STATUS, TRENDS, AND ISSUES RELATED TO ELECTRONIC DELIVERY

This memorandum is devoted to the status of, and trends and issues within, education of the handicapped which are related to the possibilities of electronic delivery of this educational service. This study is part of a broader investigation of the role of large-scale educational telecommunications systems. Thus, data are analyzed and trends and issues discussed to provide information useful to the systems designer who wishes to identify and assess the opportunities for large-scale electronic delivery of education for the handicapped.

Instruction of the handicapped child, or special education, is part of a broader field of education dealing with exceptional children, or children with non-normative characteristics. Special education seeks to prepare the handicapped student, to the best of his abilities, for as much integration as possible with the total community. This is done academically, and to an increasing extent, occupationally. The handicapped student body is heterogenous, and evidence indicates that appropriate special education programs do not reach all potential students. Only 43% of all children thought to be eligible for special education were estimated to be receiving it as of 1971. Special education seems to be more prevalent in metropolitan areas although all states have programs.

The population of handicapped youngsters in the United States has been estimated at approximately 10% of the total child population under age 19; this figure holds for the school-age handicapped population in comparison to the total student population between ages 5 and 19. As of 1968, 7,083,500 American children between birth and 19 years of age, out of an estimated 75 million, were estimated to be handicapped. 1969 estimates indicate 6,056,800 handicapped youngsters of school-age, that is, between 5 and 19.

The heterogeneity of the handicapped student body is best explained by listing each of the eight categories recognized by the Bureau of Education for the Handicapped, the 1969 percentage estimate of its share of the total student body, and the corresponding number count: those with speech impairments comprise 3.5% of all students or 2,112,600; the mentally retarded equal 2.3% or 1,388,300; the emotionally disturbed account for 2% or 1,207,200; those with learning disabilities total 1% or 603,600 students; the hearing imparied amount to .575% or 347,100; the orthopedically handicapped and other health impaired equal .5% or 301,800 students; the visually impaired total 1% or 60,400; and the multihandicapped account for .06% or 35,800 students. The scope of the impairments listed range from deficiencies of the senses to disabilities of psychomotor response. Causes, severity, and manifestations of conditions may vary. It is difficult to get an exact reading on the handicapped student population; therefore, statistics cited should be viewed with the following limitations in mind. It is assumed that many conditions remain undetected due to the unavailability of medical care or screening procedures; more than one impairment may be present in any one individual; and gross figures fail to reflect that much is dependent upon who makes the diagnosis.

Additionally, there is the question of the best educational placement of the handicapped child. Total separation or segregation, from the non-handicapped peer group is not always deemed the best solution. Accordingly, there are many options for placing the handicapped student. Special education may take place in a segregated, partially-integrated, or integrated environment. The handicapped student may attend a residential or day school. The education agency may be public or private. The most recently available evidence indicates that most placements are in public day schools. Data from 1969 records 7,000 handicapped youngsters in residential kindergartens, 87,000 handicapped children in residential schools at the elementary level, and 37,000 students in residential schools at the high school and post-graduate level. Residential placements were greatest in public institutions, by as much as 6 to 1 at the kindergarten level. Estimates from the Office of Education dated 1970-71 indicate a total of 176,000 handicapped students in residential situations while 2,982,000 youngsters were placed in local public schools. This equals an estimated special education enrollment of 3,158,000. Instruction of those confined appears to be a small proportion of the handicapped. 1963 figures reveal a total of 34,194 students receiving instruction from public agencies in other than a school setting; 28,229 students were taught at home while 5,965 youngsters were instructed in the hospital or other convalescent setting.

The degree of integration with the non-handicapped may depend upon a number of factors, possibly including the availability of facilities and personnel, such as those for occupational education; opportunities for joint activities; and the mobility of the handicapped student or the adaptability of school surroundings. A segregated, or totally separated, situation would involve either the homebound or hospitalized student receiving instruction at his place of confinement, or the youngster attending a school serving only handicapped students. Partial-integration may be accomplished by either maintaining a distinct classroom for handicapped youngsters within a "regular" school, or by a student receiving appropriate instruction on a released-time basis from his regular classroom. Released-time instruction is given by an itinerant teacher serving students at different schools; teacher and students meet in a "resource room," or designated classroom, at each school. It is the general pattern that students with speech impairments or learning disabilities receive special instruction in a resource room on a released-time basis. Total integration implies no distinction between a handicapped youngster and his non-handicapped peers. It is possible that some handicapped students considered unserved by special education within the context of this memorandum are actually totally integrated into the public education system.

While serving a distinctive and diverse student body, special education retains other distinguishing characteristics. Special education is a labor-intensive service, often provided on an expanded district basis, while the instructional design most helpful to some handicaps may prove to be easily adaptable to electronic delivery. The student-teacher ratio found in most special education classrooms, excluding those served in resource rooms, is lower than that found in most "regular" classrooms. Additionally, the handicapped child is served by a "team" of professionals: initial detection and follow-up is provided by medical professionals and para-professionals, psychologists, and social workers; specialized administrators for special instructional services swell the ranks of the classroom teachers in providing the educational component. Thus, often the only way a local system is able to provide such services is by combining resources with neighboring districts. Provision of special education has been the most prevalent motivation for inter-district cooperation.

Although it is unwise to write of instructional strategies for special education as a whole, some points may be stated regarding the suitability of electronic delivery of instruction for specific learner groups. Instructors of the mentally retarded and emotionally disturbed may define objectives in behavioral terms and construct lessons in discrete units; both strategies are amenable to instructional technology as it is now developing, particularly the electronic programmed instruction afforded by computer-aided instruction. There are application possibilities for other handicapped learners, although there currently do not appear to be many operant examples. The potential array of services offered by two-way interactive cable television may go far towards eliminating the confined instruction now given to the homebound or hospitalized. Computer-managed instruction, and its inherent potential to truly individualize instruction, may prove to be of value to all special eductors. Finally, strategies for teaching the visually impaired have long relied upon other senses. Audio technologies, particularly the large-scale technology of radio, may have an expanding role with the specialized programming services now offered by SCA on sub-channels of FM broadcast channels.

The identification of out-of-school delivery points and audiences for special education materials and services deserves attention when considering the likelihood of expanded audiences on a regional or national level. The handicapped community, their families, and the professional "team" serving them are now seemingly criss-crossed by constituent organizations and institutions. Close school-home cooperation is fostered by special educators; parental involvement in organizations dedicated to a particular handicapping condition is presumably close; service team personnel maintain their own organizations to promote continued professional development; and there undoubtedly must be some overlap among all of the groups listed. Therefore, regional or national audiences may be reached through existing constructs.

An organization of interest is the National Center on Educational Media and Materials for the Handicapped which dates from June 1, 1972. It is at the apex of regionally-based centers which provide for the development and distribution of instructional materials for handicapped learners. The functioning, decentralized network now in existence includes, among other outlets, Special Educational Instructional Materials Centers, Regional Media Centers for the Deaf, and 200 Associate Centers funded by state and local sources. This latticework system provides links between the classroom special educator, state-wide agencies, regionally-based resource centers, and centers for a nationally-based handicapped constituency, to facilitate information flow regarding new materials and media use for handicapped students. Distribution is currently via conventional means; however, National Center planners envision a more developed system relying upon electronic means to insure speed of feedback to the user, individualized responses, and prompt delivery of requested materials.

The prospects for delivering other services to the handicapped via large-scale electronic technology deserves more investigation. The team of professional medical, educational, and social science personnel necessary to identify and treat handicapped youngsters is in short supply. It is this team which provides continuous service to the handicapped youngster. Although special education itself will probably continue to retain its labor-intensive characteristics, maximizing the coverage area of medical, paramedical, and educational specialists providing evaluative, medical, and related services would appear to be of importance. The properties of swift information transfer via new technological applications, currently being developed may be very helpful to the handicapped population. Prompt dissemination of complete medical and educational files to all designated parties, with suitable safeguards for privacy, would perhaps help to assure meaningful continuity of services to the handicapped individual. Improvements in large-scale electronic communications would aid the professional personnel in this field, as in others, in keeping current with new developments so they may continually refine their service to the handicapped.

The potential role for large-scale electronic technology in the actual instruction of handicapped students will depend upon the nature of the handicapping condition. Likely to be helped by technological input to varying degrees are the educable mentally retarded, visually impaired, learning disabled, and the emotionally distrubed. The distinct learning units and repetitiveness afforded by programmed instruction may be of value to the educable mentally retarded.

The absence of emotionality and perseverance of CAI may be of great help to the emotionally disturbed. Large-scale audio technologies for the visually impaired are not the only aid to that group; closed-circuit television systems, employing special electro-magnifying devices such as the one being developed by the Rand Corporation, show promise of allowing many of those previously classified as legally blind to read normal print and write with ordinary pens and pencils. Cost of the Rand system was not available, although complete closed-circuit TV systems are now commercially available to the visually-impaired. As mechanical design and portability factors are worked out, the implications for employment, independence and education for the visually impaired may be expansionary.

Opportunities to eliminate much of the confinement surrounding multihandicaps, orthopedic handicaps, and other health impairments will grow as interactive large-scale electronic technology becomes more prevalent in homes and societal institutions. The limited experiment conducted by the Shawnee Mission/Overland Park School district in Kansas to service homebound students primarily with interactive cable television is but a hopeful beginning. An interesting hypothesis meriting further consideration is to provide completely electronic instruction for the learning disabled who, lacking a decisive neurological or pedagogical reason, fall disproportionately behind their peer group in the basic academic skill of reading. Evidence indicates that the difficulties encountered by the learning disabled are with the print medium rather than the message therein.

Prospects for utilization of large-scale electronic technology in the instruction of the hearing impaired are indeterminate, although there is much hope behind current efforts. The track record of electronic technology in aiding the hearing impaired is mixed: small-scale technology, such as improved hearing aids, have been of enormous benefit; large-scale technology, such as the telephone, radio, and television, have been less adaptable to the needs of this population. Captioned films are not new, but currently there is great interest in developing captioned television. Cultivating the hearing impaired as a distinct audience with particular programming interests, and making "regular" TV fare more available through captioning, are both current approaches. The hardware component is being refined. Costs to the broadcaster would include an encoding device to transmit captions plus personnel trained in caption composition. Costs to the consumer for a specially-equipped set to receive captioned TV would hopefully be around that of a black and white receiver. Potential difficulties loom in the software component. Hearing impaired individuals who are deaf or who lost their hearing at young age, have little residual hearing ability, and may not have acquired the requisite language base or reading ability to utilize captioned television to its fullest potential. For those older adults undergoing a hearing loss, captioned television may have the utmost importance. A demonstration currently being conducted with computer-aided instruction for hearing-impaired students across the country shows a cost of 60¢ per student session. This cost figure is cited based upon conditions of use, including communication by telephone line; it is felt that satellite interconnection might prove more economical under certain conditions. Work on the written language patterns of hearing-impaired secondary students being done in connection with this demonstration may prove helpful in "breaking the software barrier" with severely hearing-impaired users.

Prospects for utilizing large-scale electronic technology are less well developed regarding the instruction of the speech impaired. Many of the students classified as speech impaired display relatively minor speech and articulation problems. Their special education largely consists of learning the correct way to articulate and concentrating on this while speaking. This is usually accomplished by a trained speech teacher working with small groups and using few, if any, technological aids. Other children classified as speech impaired display problems of greater magnitude resulting from hearing disorders or neurological insult. Application of large-scale electronic technology to their instructional situation may have more meaning, and also may be in place if they are already in special schools, classes, or clinics.

A final issue regarding the prospects for applying large-scale electronic technology to special education concerns funding sources for purchase of new equipment. Funds for special education, and handicapped individuals themselves, are available from public and private sources; all levels of government and charitable organizations are prominent examples. The extent to which these sources would make available the additional funding which may be necessary to purchase equipment so that large-scale electronic technology would have increased usage in special education and the life style of the handicapped remains an unresolved question. Insofar as handicapped youngsters are educated in a partially-integrated or integrated environment, the requisite hardware may already be in place in the school setting. Utilization may then depend upon the suitability or adaptability of existing instructional software, assuming that creation of specially-tailored material would be needed but too costly.

It may be assumed, however, that even with the input of large-scale electronic technology,special education will still retain its labor-intensive characteristic. A relatively small handicapped population, further splintered among specific disability groups, ideally receives the services of a full professional team. Beyond the classroom level, it is possible that the coverage area of those providing services may be expanded by large-scale electronic technology, but whether that will yield a cost reduction as well as improved services remains uncertain.

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EDUCATION OF THE HANDICAPPED CHILD:

STATUS, TRENDS AND ISSUES RELATED TO ELECTRONIC DELIVERY

1. INTRODUCTION AND DEFINITION OF TERMS

This memorandum contains an assessment of the prospects for use of large-scale, electronic delivery of materials and technology for use in education of the handicapped child. The education dilemma of meeting individual student needs while maintaining a balance with the social benefits derived from group experience is nowhere more apparent than in education for the handicapped child. Initially, the current status of special education for the handicapped student is examined, with emphasis upon the variety of settings in which instruction may take place and the variety of professional personnel involved in serving the handicapped student body. Attention is then given to the technological delivery of, or technological aids in delivering services to this student population. Based upon these findings, an analysis is made of future trends within this educational specialty and the implications these hold for the role of large-scale electronic technology. It is hoped that the information contained in this memorandum will provide input useful to those involved in the design of large-scale educational telecommunications systems.

The Education of Exceptional Children is a pedagogic specialty dealing with the instruction of children of exceptional, or non-normative, characteristics. Concentration is primarily upon intellectually gifted students, disadvantaged youngsters, and children with handicapping conditions. This memorandum will concentrate exclusively upon the handicapped aspect of exceptionality.

Special Education is the appropriate term to use when speaking specifically of education for the handicapped child. This designation will be used throughout this memorandum. The conceptual framework of special education is broader than rehabilitation, encompassing the notion of suitable academic instruction. Increasingly, the scope of special education is broadening to include an occupational component. The ultimate goal of such educational efforts is to equip the student with the necessary skills, requisite with individual ability, to facilitate as much integration as possible into the total community.*

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*This memorandum is concerned with the existing state of education for the handicapped, much of which takes place under the rubric of "special education." The exploration of status, trends, and issues couched within this term throughout the memorandum is not meant to ignore the opinion held by some professionals serving the handicapped that the practice of placement in special educational situations should be eliminated. For a further explanation of this position see S. S. Sodhi, "Specialness of Special Education," available from ERIC, #ED 065 981.

A Handicap (or Handicapping Condition), as used within this memorandum, is considered a physical or mental impairment* of sufficient severity to mandate an education designed with that condition in mind. "Sufficient severity" should not construed to mean a totally disabling condition, but rather one of such magnitude that special considerations be given it. There are wide variations within the handicapped student body involving differences in handicapping condition, differences in severity of handicap, and differences regarding the cause of the condition.

1.1 ISSUES RELATED TO DISCUSSION OF HANDICAPPING CONDITIONS

Prior to enumerating the handicapping conditions recognized by law and the Bureau for the Education of the Handicapped (BEH), some qualifications are in order. These caveats are discussed to enable the reader to more completely understand the nature of this student body.

The first qualification is the overlapping of handicapping conditions. Although this memorandum describes the handicapped student body in categorical terms, the reality may not always correspond to such neatly packaged contours. A handicapping condition need not exist in a vacuum, but may be accompanied by other impairing conditions. A frequent example is the emotional imbalance induced by the presence of another disabling condition which impedes reactions, communicative abilities, or any other means of human response to everyday situations. Yet another instance is the multiplicity of effects caused by neurological disorders. Handicaps of the senses, speech impairments, and degenerative diseases may all be reflective of neurological difficulties, albeit manifested in different ways. Thus one impairment may often be accompanied by other, secondary, impairments.

The second qualification concerns the reliability of the handicapping classification. Placement of the individual in one or another of the handicapping classifications may often be a matter of assignment depending upon who makes the diagnosis. This may be particularly relevant to those conditions which are less well-defined physically, e.g., Learning Disabilities. In the early stages handicapping conditions may often be mistaken; this takes on particular poignancy when disadvantaged youngsters are considered mentally retarded due to inarticulateness and lack of familiarity with abstract thinking stemming from socio-cultural, rather than physical, causes. Therefore, the exact counts of the handicapped student population might be viewed with this consideration in mind.

The third qualification is that the procedure for identifying handicapping conditions is not foolproof. Some handicapping conditions may be apparent at birth while others may not be manifest until the child is of school age. Therefore, barring a condition resulting from an accident, a handicap may be discovered in a number of ways. A handicapped pre-school age child may have been initially diagnosed by a physician, whether at birth or during the developmental stages of infancy or early childhood. Some conditions emerge as the child matures and fails to exhibit "normal" developmental traits; this may be initially noticed by the parents, but diagnosis will generally be made by the physician or those consulted on referral. Conditions often diagnosed in this way include many with a neurological base, examples of which are degenerative disorders and handicaps of the senses.

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*Impairment is not a precise medical term, rather one denoting to the layman any injury, deterioration, or decrease in acuity of a physical or mental function or process.

Other handicapping conditions may be discovered upon school entrance by screening procedures and developmental difficulties that surface at that time. Examples of the former are audiological testing conducted by many school districts to uncover hearing impairments. Examples of the latter include Learning Disabilities and problems of Emotional Disturbance which may not have been apparent prior to constant peer group interaction.

A special point should be made regarding differing diagnoses. This should not be considered unusual, particularly when speaking of individuals who are exhibiting no clear-cut physical signs pointing to one obvious explanation over another. Should the parents have the resources and time to pursue the matter beyond the original physician or educational system spotting a difficulty and presenting a diagnosis, they may be beguiled by an array of diagnoses, possibly contradictory in nature.

This system of diagnosis may be spotty; unavailability of pediatric care coupled with the inability of many school districts to provide screening procedures and the adjunct professional personnel to carry out the task gives rise to the possibility that many problems remain undetected and untreated.

The fourth qualification concerns the optimum educational placement of handicapped students. Distinct school operations for handicapped students may not always be the most desirable solution. Other considerations, such as the degree to which the handicapped student can take part in joint activities with his peers from regular classes may mitigate against complete segregation of the handicapped student population. Some conditions lend themselves more readily to some degree of integration than others; a hard-of-hearing child with proper training and suitable acoustical equipment may have less difficulty attending a regular school than an immobile child of normal intelligence who uses instruments to aid his movement, and who may face architectural barriers in a building not specifically designed for his needs.

1.2 DEFINITIONS OF HANDICAPPING CONDITIONS

The Bureau of Education for the Handicapped estimates for 1969 indicate 6,056,800 handicapped children of school age. Of the approximately 75 million children in the United States between birth and 19 years of age as of July, 1968, 7,083,500 were estimated to be handicapped in one way or another. The BEH estimates for 1969 that approximately 10%

of the total school age population, ranging in age from 5 - 19, fall into one of the following classifications:

1.2.1. Speech Impairments:

Conditions commonly included within this category are stuttering, lisping, or inability to form certain letter sounds. Many of these problems yield to corrective therapy during the primary years. Speech impairments may accompany hearing problems, and may also be exhibited by children with other neurological problems. BEH estimated incidence levels among children aged 5 to 19 for 1969 place speech impairment as the most prevalent handicapping condition affecting 3.5% of the total student body, or some 35% of all handicapped children. These percentages translate into 2,112,600 school-aged youngsters with speech impairments.[1]

1.2.2. Deafness and Hard of Hearing:

Whether considered separately or as a matter of degree, deafness and hard of hearing refer to the loss of aural acuity which usually results in related speech and verbal communication problems. The degree of impairment may produce commensurate difficulties in assembling a mental language base which, in turn, is the cornerstone for much cognitive learning.* During 1969, the BEH estimated that both classifications accounted for approximately .6% of children between the ages of 5-19; .5% categorized as hard of hearing, and .075% regarded as deaf. In numerical terms, there were an estimated 347,100 hearing-impaired children of school age; 301,800 of whom were considered hard of hearing, and 45,300 of whom were considered deaf.

1.2.3. Visual Impairments:

Students within this category display a loss of visual perception which fails to conform to "normal" sight with the aid of corrective lenses. Instruction for these students has traditionally relied upon the other sensory modes. Visually impaired students accounted for .1% of the student body of 1969, or 60,400 students, according to the BEH estimates.

1.2.4. Orthopedic Handicaps:

Commonly known as crippling conditions, such impairments affect physical mobility and motor response by affecting the limbs and/or spinal cord. Literature from the Bureau of Education for the Handicapped often combines certain, but not all, orthopedic conditions with the category Other Health Impaired. In the case of other health impaired students, restricted activity may be due to prolonged post-operative recovery or conditions of continued delicacy (e.g., heart defects). 1969 estimates indicate a combined incidence level of .5% of the student population; numerically, there were 301,800 orthopedically handicapped or other health impaired students.[1] Multihandicapped: Another related category, the multi-handicapped are the smallest component of the handicapped student population. Children representative of this group may be considered incapacitated due to the presence and severity of more than one handicapping condition or a degenerative disease. Generally, these students might be considered homebound. An example would be muscular dystrophy sufferers. The Bureau of Education for the Handicapped estimates .06% of all students, or 35,800 were multi-handicapped in 1969.[1]

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* A possible means of distinguishing between the categories is to consider a deaf student to be one who lost his hearing prior to language development and to consider a hard of hearing student one who lost his hearing after language development. This distinction has been offered by Brown et. al. [46]

1.2.5. Mental Retardation

This category accounts for the second-highest incidence level of handicapped students, 2.3% of the total student body in 1969, or 23% of the handicapped student body. This means an estimated 1,388,300 school aged youngsters.[1] Indeed, most of the special education classrooms in the United States exist for this student body. In the broadest sense, mental retardation means an imbalance between the individual's social and cognitive behavior and chronological age which stems from a physical deficit to the brain. Medical science is unable to completely account for all the causes that would produce this condition. In some cases such as phenylketonuria (PKU)*, a cumulative retardation may accrue due to a chemical imbalance; in other cases, such as Down's Syndrome (mongolism), retardation is due to a chromosomal abnormality.

The educator tends to define mental retardation in operational terms, e.g., an I.Q. reflecting achievement below that which falls in the lower range of the normal curve. Different sub-categories of mental retardation are recognized, of which the educable mentally retarded and the trainable mentally retarded have the most significance when speaking of educational efforts. The 1970 White House Conference on Children estimated that the mentally retarded school-age population was composed 75% of educable mentally retarded, 8% of severely retarded (many of this group being trainable), and 2% of profoundly retarded (being unable to care for themselves).[2]

1.2.5.1 Educable Mentally Retarded:

Students designated in this fashion generally fall into the I.Q. range of 50 to 75, placing their highest levels just below the lower extremity of the "normal" population. Educable mental retardates may seem "slow;" the essential educational goal for this group is to attain the rudiments of academic instruction, such as basic computation and the hallmarks of literacy, the ability to read and write. This educational preparation is made in the expectation that many of these students will be able to assume the role of average citizens during adulthood; entering marriage, having families, and assuming jobs commensurate with their (limited) abilities.[3] The BEH estimated that 723,747 educable mentally retarded students were served by public sources (institutions and education agencies) during 1971.[1]

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*PKU - Phenylketonuria is a congenital enzyme deficiency causing an accumulation of phenylalanine metabolites, which in turn produces brain damage. A low phenylalanine diet may prevent brain damage.

1.2.5.2 Trainable Mentally Retarded:

Students designated in this fashion generally fall into the I.Q. range of 30 to 50. Usually separate classrooms from those for the educable mentally retarded are maintained for this group. Since retardation is more severe, educational goals are proportionately more limited. The educator of the trainable mentally retarded aims for basic self-sufficiency in his pupils; the ability to dress, handle basic needs, feed oneself, etc. This segment of the mentally retarded population will be expected to live under constant supervision throughout its life, whether in individual homes or residential institutions.[3] The BEH estimated that 148,466 trainable mentally retarded students were served by public sources (institutions and education agencies) during 1971. [1]

1.2.6 Learning Disabled:

Individuals falling into this category have been recognized in medical literature within the past century and by special education far more recently. Medical and educational definitions tend to agree that learning disabilities occur in the absence of deficient teaching or other educational impediments, and in the absence of definitive neurological deficits. Despite the lack of definitive pedagogical or physical causes, these students exhibit great difficulties in mastering basic instructional tasks. A most prevalent learning disability is dyslexia, when reading and spelling performance fall below the student's measured ability and/or observed behavior. Should this imbalance become disproportionate, dyslexia becomes a handicapping condition. Difficulties often concommitant with dyslexia include poor penmanship, poor drawing ability, and poor ability to write numbers. Learning disabled children sometimes exhibit the secondary physical characteristics of cluttered speech or extreme clumsiness, thus adding to the tendency to attribute their problems to a neurological deficit. Generally, this student population is mostly male and may come from families in which similar difficulties have previously been noted. To a greater extent than mental retardation, learning disabilities are comparative; largely for this reason, educational efforts have been remedial rather than preventative. The Bureau of Education for the Handicapped estimates that 1% of the student body, or 603,600 youngsters, during 1969 was comprised of students with learning disabilities.[1]

1.2.7. Emotionally Disturbed:

This student group, comprising an estimated 2% of the student population in 1969, or 1,207,200 youngsters,[1] includes children with psychological difficulties which preclude satisfactory adjustment in in the usual classroom situation.

1.2.8. Summary of the Estimated Handicapped Child Population*

Table I, shown on the following page, presents a breakdown of the handicapped student body, by exceptionality, in both percentage and numerical terms. Table I also presents numerical estimates for both the school-age and total child population with each exceptionality.

1.3 OVERVIEW OF MEMORANDUM

Having thus identified the segments of the handicapped student population, this memorandum will continue to explore the current status of special education in chapter 2. Attention will be focused upon the types of institutions providing special education, and the types of handicapped students most likely and least likely to receive special education. A geographical analysis is presented in which geographical factors affecting the provision of special education are examined. Chapter 3 continues by examining the different configurations for delivering special educational services. Three basic configurations will be recognized and discussed. A primary delivery point is the special education classroom, whether permanent or itinerant. Various types of district-level organizations will be noted. Finally, those markets outside the formal school structure will be discussed.

Distinctive features of special education will be examined in Chapter 4. The labor intensiveness of special education, embodying the notion of a team of professional personnel and administrators, is a salient feature. The instructional design of some special education will be discussed as it pertains to mediated delivery, that is, instruction delivered via one or more of the electronic technologies.

Chapter 5 examines the costs and financing of special education. Support will be analyzed both in terms of support for the agency providing services and support to the individual. The following chapter, Chapter 6, discusses existing organizations for delivery of special education services to a national or regional audience. Constructs include organizations serving professional special educators, parents of handicapped children, and other professionals serving the handicapped child.

Chapter 7 concentrates upon technological delivery of, and technological aids in delivering, services to the handicapped. This chapter examines the technology in terms of each handicapping condition. The remaining chapter, Chapter 8, presents conclusions regarding the suitability of large-scale electronic technology for delivery of special educational services. Conclusions are discussed in terms of in-school applications, out-of-school applications, related services, and organizational constructs.

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*A recent report by Kakalik et al., entitled Services for Handicapped Youth: A Program Overview cites more recent figures on the number of handicapped. It also underscores the multiplicity of programs serving the handicapped and the fractionalized delivery of existing services.[50]

TABLE I. ESTIMATED HANDICAPPED CHILD POPULATION, BY EXCEPTIONALITY , 1969

Exceptionality	% of 1969 Handicapped* Student Body (5-19 yrs. old)	% of 1969 Total* Student Body (5-19 yrs. old)	Estimated School-Age Population with Exceptionality	Estimated Population with Exceptionality ages 0-19
Speech Impaired	35.00%	3.500%	2,112,600	2,440,500
Hearing Impaired	5.75%	.575%	347,100	400,900
1. Deaf	.75%	.075%	45,300	52,300
2. Hard of Hearing	5.00%	.500%	301,800	348,600
Visually Impaired	1.00%	.100%	60,400	69,800
Orthopedically Handicapped and Other Health Impaired	5.00%	.500%	301,800	348,600
Multihandicapped	.60%	.060%	35,800	40,900
Mentally Retarded	23.00%	2.300%	1,388,300	1,697,500
Learning Disabled	10.00%	1.000%	603,600	697,300
Emotionally Disturbed	20.00%	2.000%	1,207,200	1,388,000

*The total handicapped student population should equal slightly more than 10% of the total student population ages 5-19.

Source: Compiled from estimates supplied by the Bureau of Education for the Handicapped for 1969, dated October, 1971.

2. CURRENT STATUS OF SPECIAL EDUCATION

The size of the handicapped student body hovers around 10% of the total school-age population in the U.S., which is defined by the Bureau of Education for the Handicapped as those between the ages of 5 - 19. During 1969, 10.035% of the U.S. school-age population was considered handicapped. Estimates from the BEH as of October, 1971, reflecting 1969 data indicate a total of 7,083,500 handicapped children, 6,056,800 of whom were of school age. Of the total population of handicapped youngsters, an estimated 2,857,551 were served by special education programs.[1] Most of those were served in publicly provided facilities, primarily day schools.

2.1 EXTENT OF PROVISION OUTSIDE OF LOCAL PUBLIC DAY SCHOOLS

The vast preponderance of special education takes place in local public (day) schools. United States Office of Education estimates for the 1970-71 school year indicate 2,982,000 students enrolled in public day programs and 176,000 enrollees in residential programs, whether public or private (Table II, next page). These figures combine to yield a total handicapped enrollment in special classes of 3,158,000 youngsters. Comparing the 1970-71 estimates with the 1963 data also presented in Table II, one notes that enrollment in special classes had almost doubled. Enrollment growth was concentrated in public day programs which nearly doubled from 1,570,370 to 2,982,000. While residential placements also grew, the numbers appear almost incremental by comparison, rising from 111,981 to 176,000 during the 8-year interim.[4]

Table II also indicates that the heaviest concentration of pupils in residential schools are the emotionally disturbed and mentally retarded. Of both groups, indeed of all groups, only residential enrollment for the emotionally disturbed constituted a majority of placements; furthermore, some of the residential placements for emotionally disturbed students apparently are in public mental hospitals (see reference 4, Table II).

Although the mentally retarded were the second heaviest users of residential facilities, the numbers enrolled were a relatively small percentage of both total school enrollment and local public school enrollment. Contrast those enrollment figures with those for the visually impaired; the visually handicapped constitute a much smaller school-age population, but approximately one-third of its total enrollment is in residential schools, a ratio which has held constant between 1963 and 1971. The same general proportions apply to placement of deaf and hard of hearing students, even though there had been a marked enrollment increase during the 8-year period.

Residential placements by grade level are greatest during the elementary school years, or grades 1-8. 1969 figures indicate 87,000 exceptional children in residential elementary schools, as opposed to 37,000 students in residential secondary and post-secondary institutions. There were 7,000 handicapped youngsters in residential kindergartens. At each instructional level, placement in public residential schools

TABLE II. ENROLLMENT IN SPECIAL EDUCATION PROGRAMS FOR EXCEPTIONAL CHILDREN: UNITED STATES, FEBRUARY 1963 AND 1970-71

Area of exceptionality[1]	1963			1970-71[2]		
	Total enrollment	Local public schools	Public and private residential schools	Total enrollment	Local public schools	Public and private residential schools
1	2	3	4	5	6	7
Total.	1,682,351	1,570,370	111,981	3,158,000	2,982,000	176,000
Visually handicapped.	21,531	13,962	7,569	24,000	16,000	8,000
Deaf and hard of hearing. . .	45,594	28,551	17,043	78,000	50,000	28,000
Speech impaired	802,197	802,197	([3])	1,237,000	1,237,000	-----
Crippled and special health problems.	64,842	64,842	([3])	269,000	269,000	-----
Emotionally and socially maladjusted.	79,587	30,871	[4]48,716	113,000	42,000	71,000
Mentally retarded	431,890	393,237	38,653	830,000	761,000	69,000
Other handicapping conditions	22,039	22,039	([3])	126,000	126,000	-----
Gifted.	214,671	214,671	([3])	481,000	481,000	-----

[1] Pupils are reported according to the major type of exceptionality for which they are receiving special education.

[2] Estimated on the basis of State reports to the Office of Education.

[3] Not included in survey of residential schools

[4] Includes education programs in public hospitals for the mentally ill.

Source: Digest of Educational Statistics 1972, National Center for Educational Statistics, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D. C. (1973).

predominated over private residential placements. The margin could be as great as 6 to 1, as it was on the kindergarten level; by the secondary grades, the margin had declined to slightly better than 3 to 1.

Limited data available makes it difficult to analyze private provision of special education in more specific terms. However, the Third Annual Report of the National Advisory Committee on Handicapped Children (1970) notes that 20,000 youngsters were enrolled in special classes within the Catholic school system. Using the Committee's estimate of 12% of the total school enrollment within Catholic institutions during 1969, or 5,042,270,[5] the 20,000 handicapped students enrolled in these schools would give further credence to the idea that most special education continues to take place within publicly controlled institutions.

Table III (page 12) provides information on instruction provided in other settings by local public schools. Of interest here are columns 5 and 6, labeled "In home instruction" and "In a hospital, sanitorium, or convalescent home ," respectively. As of 1963, the greatest demand for in home instruction came from those students who were orthopedically handicapped or suffered from other health impairments.* As was stated in Section 1.2.4, this is probably due to the physically confining nature of many of these maladies. The demand for instruction in other non-school environments (column 6) may largely be traced to the same user group.

2.2 EXTENT OF PROVISION BY PUBLIC AGENCIES (INSTITUTIONS AND SCHOOLS)

The most recent estimates available from the Bureau of Education for the Handicapped, as of October, 1971, cover services extended by public institutions and public education agencies.

2.2.1 Coverage of Specific Groups by Public Education Agencies

Who are the exceptional students most likely to be served by special education programs? The question is not posed in the spirit of ferreting out biases, but in the interests of seeking to establish whether some groups have greater access to appropriate programs due to whatever factors may help to determine this (e.g., more certain identification of the handicapping condition, greater student mobility,etc.).

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*Descriptive categories, as used within the text, are those that have been defined in the Introduction to this memorandum (Section 1.2), and may not exactly correspond to those cited within various tables. Whether crippled children are referred to as "crippled" or "orthopedically handicapped" is only a matter of choice; the underlying explanations of conditions encompassed within each category remains the same. In the interests of uniformity, descriptive titles as stated within the Introduction will be used throughout the memorandum, unaffected by time and changing terminology, as evidenced by assorted tabular data.

Table III. PUPIL ENROLLMENT IN PROGRAMS OPERATED BY LOCAL PUBLIC SCHOOLS BY TYPE OF PROGRAM ORGANIZATION: 1963

Area of exceptionality	Total	Full-time in special class or in special day school	Part-time in special programs and part-time in regular class[2]	In home instruction	In a hospital, sanitorium, or convalescent home	In residential school	Not reported by type of program
1	2	3	4	5	6	7	8
Total	1,570,370	456,145	986,509	28,229	5,965	4,092	89,430
Visually handicapped, total	13,962	5,975	7,426	136	20	12	392
Blind	4,405	1,950	2,242	56	17	12	128
Partially seeing	9,529	4,021	5,164	77	3	---	264
Not reported separately	28	5	20	3	---	---	---
Hearing-impaired, total	28,551	10,274	17,744	71	15	---	447
Deaf	6,612	5,435	960	49	12	---	156
Hard-of-hearing	20,219	3,669	16,233	22	3	---	272
Not reported separately	1,720	1,150	551	---	---	---	19
Speech-impaired, total	802,197	---	802,197	---	---	---	---
Speech-impaired	704,185	---	704,185	---	---	---	---
Speech and hearing	---	---	---	---	---	---	---
Not reported separately[3]	98,012	---	98,012	---	---	---	---
Crippled and special health problems, total	64,842	27,386	7,417	20,296	5,269	192	4,282
Crippled	26,538	15,336	1,746	4,822	1,796	78	2,760
Special health problems	30,684	9,304	5,420	13,207	1,948	114	691
Not reported separately	7,620	2,746	251	2,267	1,525	---	831
Emotionally disturbed and socially maladjusted, total	30,871	15,780	8,136	1,271	641	3,843	1,200
Emotionally disturbed	9,677	3,456	4,450	916	313	52	490
Socially maladjusted	11,769	6,170	2,732	189	142	1,960	576
Not reported separately	9,425	6,154	954	166	186	1,831	134
Mentally retarded, total	393,237	339,596	40,862	6,375	---	45	6,359
Upper range	361,265	310,108	40,135	6,217	---	45	4,760
Middle range	30,022	27,723	600	150	---	---	1,549
Not reported separately	1,950	1,765	127	8	---	---	50
Gifted	214,671	49,624	89,510	---	---	---	75,537
Other, total	22,039	7,509	13,217	80	20	---	1,213
Severe learning disability[4]	13,434	1,917	10,799	---	---	---	718
Brain-injured[4]	2,472	1,479	924	35	---	---	34
Culturally restricted[4]	4,380	3,555	825	---	---	---	---
Not reported by area of exceptionality	1,753	558	669	45	20	---	461

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[1] Data based on a 1963 status study of special education conducted by the Office of Education.

[2] Includes instruction in a regularly scheduled special class or by a special, itinerant, or resource teacher together with some time in a regular class.

[3] All enrolled in a speech and hearing program are assumed to be part-time although it is recognized that a small number may be in self-contained special classes.

[4] These categories were not included in the questionnaire sent to the schools, but were frequent write-in replies. The figures might have been much larger if the data had been requested.

Source: Romaine Mackie, Special Education in the United States. Statistics 1948-1966.
New York: Teachers College Press, 1969.

The exceptionality with the highest percentage of its school-age population covered by special educational programs is the mentally retarded. Figures derived from BEH estimates regarding the total school-age population with this condition and numbers currently served,* indicate that 62% of those children assumed eligible for special education for the mentally retarded were receiving it as of Ocotber, 1971.

Other exceptionalities posting percentages in the same range were: the speech impaired, with 60% of those eligible receiving special instruction; the orthopedically handicapped and other health impaired, with 60% of the estimated total covered; and the visually impaired, with 50% of such students getting appropriate training.

Coverage of the special education school-age population drops for the remaining exceptionalities. 20% of the students with learning disabilities are reached; 20% of the hearing impaired (deaf and hard of hearing) receive specialized instruction; 26% of the multi-handicapped get appropriate training; and 10% of the emotionally disturbed receive specially-tailored education.

Conclusions, indeed even inferences, are difficult to draw from the data provided here. Exceptionalities with low percentages in special education include two which present diagnostic difficulties (learning disabilities and emotional disturbance) and two which presumably do not (hearing impairments and multihandicapped). Exceptionalities with significantly higher percentages in special education include those which indicate problems of mobility (orthopedic handicaps and other health impairments) and those which largely would not (speech impairments).

Note should be taken of special services to pre-school aged handicapped children, those between birth and 5 years of age. Although BEH estimates indicate that every state and the District of Columbia provide special education for at least some portion of its handicapped residents of school age (see section 2.2.2), the same data indicates that only 19 states provide special education for its pre-school aged handicapped residents. Numbers of pre-schoolers reached vary from a high of 8,079 in Pennsylvania to a low of 17 in Maine. Nationally, 25,684 handicapped pre-schoolers are served by public education agencies.[6]

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*The percentages cited were figured as follows: the estimate supplied by the BEH for the total school-age group with any one exceptionality was divided into the estimate supplied by the BEH for the special education enrollment for that exceptionality.

2.2.2 Special Education Coverage by Geographic Area

Data is presented in this section in two ways: 1) total numbers of handicapped residents in each state under age 21, and 2) percentage of that statewide total served by special education. Nationally, 43% of the handicapped minors are estimated to be reached by special education offered through public agencies.[6]

With two exceptions, the highest reported estimates of statewide totals for handicapped minors* correspond to the ten most populated states. Missouri and North Carolina replace Massachusetts and Florida in this roster. These BEH estimates are partially based upon estimates from the individual states and are dated October 1971. The individual states estimating the highest population concentrations of handicapped minors are: California, Illinois, Michigan, Missouri, New Jersey, New York, North Carolina, Ohio, Pennsylvania, and Texas. The range is from a high of 777,731 for Texas, to a low of 172,580 for North Carolina.[6]

Of the ten states reporting the highest estimates of total number of handicapped minors unserved, three are not among the ten most populated states. Arkansas, Oklahoma, and Missouri are the three states. The ten states estimating the greatest numbers of unserved handicapped minors are: Arkansas, California, Michigan, Missouri, New Jersey, New York, Ohio, Oklahoma, Pennsylvania, and Texas. The estimated range is from a high of 602,069 for Texas, to a low of 108,619 for Pennsylvania. Both Illinois and North Carolina, states which were listed among those with high concentrations of handicapped minors, failed to appear among those states with the greatest numbers of unserved handicapped minors.[6]

An analysis of the geographic distribution of the handicapped gives rise to the tentative conclusion that handicapping conditions are evenly distributed across population; wherever one finds higher population concentrations, one will find higher numbers of handicapped individuals.

Other explanations are not forthcoming from a geographic analysis. For instance, examination of the percentage of handicapped minors served by special education in each state (Figure 1) does not indicate a marked preponderance in favor of one section of the country over another. Neighboring states may register markedly different percentage-served figures; consider the 16% served in Oklahoma vis-a-vis the 50% served in Kansas. Conversely, neighboring states may register remarkably similar percentage-served figures; consider the 59% served

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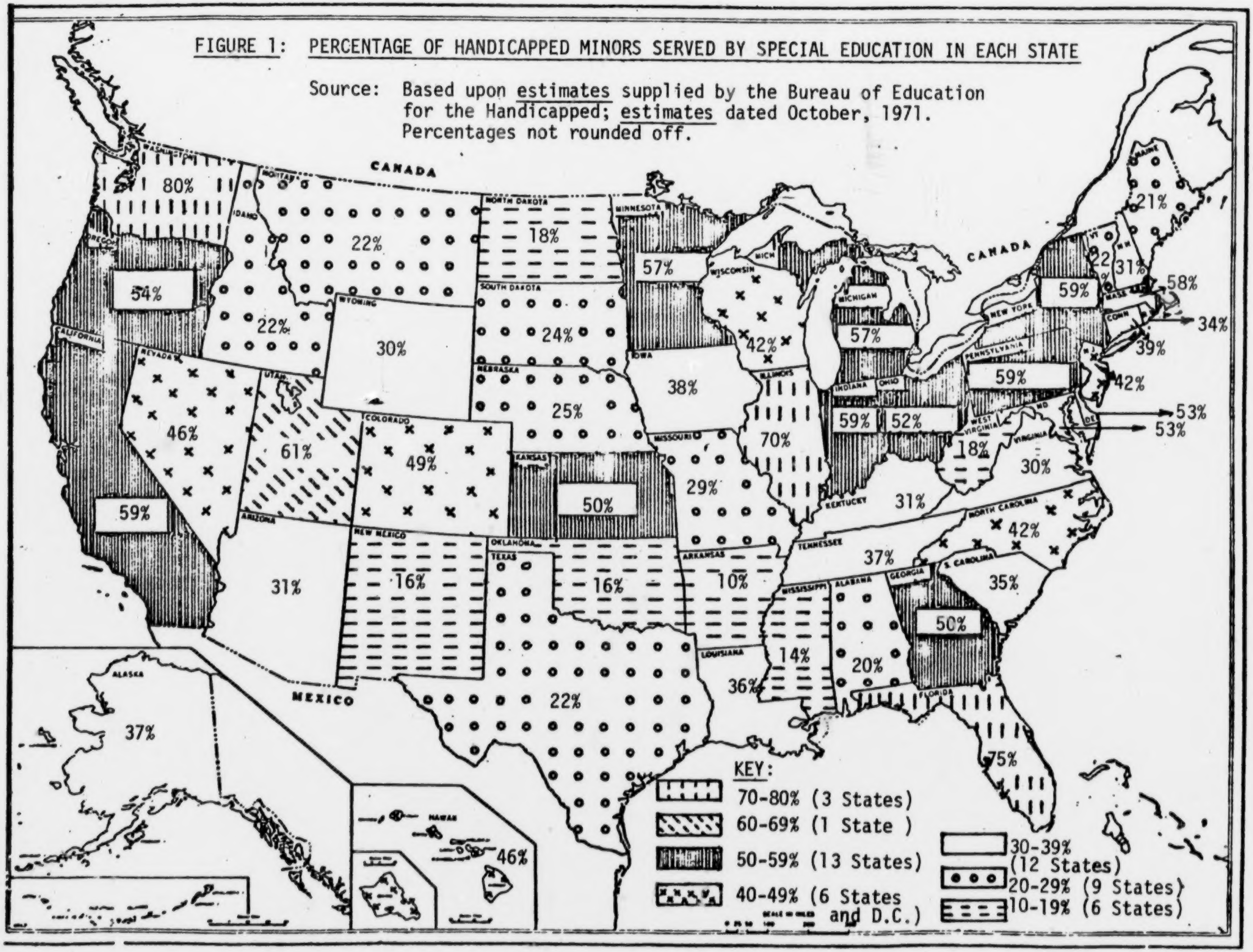
*The figures upon which these calculations are based cover the handicapped population served between the ages of 0 - 21. Presumably the figures cited for the unserved population represent the same age range. Therefore, the substitution of the term "minors" for "students," since the designation handicapped students had previously been reserved for those between the ages of 5 - 19. (Section 1.2).

FIGURE 1: PERCENTAGE OF HANDICAPPED MINORS SERVED BY SPECIAL EDUCATION IN EACH STATE

Source: Based upon estimates supplied by the Bureau of Education for the Handicapped; estimates dated October, 1971. Percentages not rounded off.


CANADA
WASHINGTON 80%
OREGON 54%
CALIFORNIA 59%
IDAHO 22%
MONTANA 22%
NEVADA 46%
UTAH 61%
WYOMING 30%
ARIZONA 31%
COLORADO 49%
NEW MEXICO 16%
NORTH DAKOTA 18%
SOUTH DAKOTA 24%
NEBRASKA 25%
KANSAS 50%
OKLAHOMA 16%
TEXAS 22%
MINNESOTA 57%
IOWA 38%
MISSOURI 29%
ARKANSAS 10%
LOUISIANA 36%
WISCONSIN 42%
ILLINOIS 70%
MICH
MICHIGAN 57%
INDIANA 59%
OHIO 52%
KENTUCKY 31%
TENNESSEE 37%
MISSISSIPPI 14%
ALABAMA 20%
GEORGIA 50%
FLORIDA 75%
S. CAROLINA 35%
NORTH CAROLINA 42%
VIRGINIA 30%
WEST VIRGINIA 18%
MD 53%
DE 53%
PENNSYLVANIA 59%
NEW YORK 59%
NJ 42%
CONN 39%
RI 34%
MASS 58%
VT 22%
NH 31%
MAINE 21%
ALASKA 37%
HAWAII 46%
MEXICO
KEY:
70-80% (3 States)
60-69% (1 State)
50-59% (13 States)
40-49% (6 States and D.C.)
30-39% (12 States)
20-29% (9 States)
10-19% (6 States)

in both Pennsylvania and New York.

Although percentage figures are derived from differing population totals for each state, some points may be noted. Only four states reach more than 60% of their handicapped youngsters with special education. These states are Washington, Illinois, Florida, and Utah, none of which are in close proximity to each other. Percentage data is concentrated around two ranges; 13 states reach between 50-59% of their handicapped youngsters, and 12 states provide special education for 30-39% of their handicapped youngsters.

Analysis of percentage data along an urban state-rural state dichotomy is uninstructive. North Carolina, which is 55% rural in character,* reaches 42% of its handicapped population under 21 years of age. North Dakota, 55.7% rural, reaches 18% of its handicapped population under 21 years of age. However, states with less than 50% of their population classified as metropolitan residents** generally report comparatively lower percentages of handicapped youngsters served by special education. New Mexico, with 31.1% metropolitan residents, provides services for 16% of her handicapped minors. When metropolitan concentration nears 50%, the percentage of handicapped youngsters served will also rise. Tennessee has 48.9% of her residents in metropolitan areas. Tennessee serves 37% of her handicapped population under 21 with special education. The coincident relationship between metropolitanism and increases in handicapped minors reached should be viewed equivocally; for instance, a metropolitan percentage was not given for Alaska, which reaches 37% of its handicapped youngsters. Washington D.C., classified as 100% metropolitan, reaches 43% of its handicapped minors.

As previously stated, a geographic analysis presents a large inconclusive patchwork. The only hypothesis generated is that special education appears to be a metropolitan phenomenon. There is one other potential explanation for the apparent lack of geographical consistency in reaching handicapped minors. Individual state laws regarding the extension and availability of social and educational services may be influential in producing no consistent geographic pattern. Thus it is possible that the administrative organization of state agencies, the extent of medical screening procedures, legislative intent and available funding, plus the cultivation of public consciousness regarding education of the handicapped may all vary from state to state, producing a more formidable combination in any one state rather than another.

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*The percentage designation "rural" is derived from the Statistical Abstract of the United States: 1972, Table 18, in which the "Percent of state or division" designated "urban" is given for 1970. Subtracting the urban percentage from 100.00 provided the percentage designated "rural."

**The percentage designation "metropolitan residents" is taken from the Statistical Abstract of the United States: 1972, Table 18, column 3, in which the "Percent of State or division" designated "metropolitan" is given for 1970.

3. DELIVERY POINTS FOR SPECIAL EDUCATION

Special education offered in a day school setting may be delivered to a variety of outlets. The outlets may be considered organized into a hierarchical system, building from the classroom level to the district level. What is distinctive about this organizational form as it relates to special education is that at either level a variety of approaches may be employed due to the wide variations in the school population to be served and its numerical scarcity in relation to the total school population.

3.1 AT THE INDIVIDUAL CLASSROOM AND INDIVIDUAL SCHOOL LEVEL

School buildings housing exclusively handicapped students are not the only solution to provision of special education. That type of arrangement would be considered a segregated environment, since the handicapped learner is placed in a totally separate school situation, follows an appropriate educational procedure, and interacts exclusively with children having either the same, or another, exceptionality.

Children who are either homebound or hospitalized may generally be considered in a segregated learning environment. Unlike students in distinctive special schools, the homebound or hospitalized youngster is not in a school environment and, to that extent, this situation may be considered an atypical segregated environment. Interaction with other children may be limited, at best. A classroom situation may not be possible; by implication, a tutorial atmosphere is established. Instruction is generally provided by an itinerant (traveling) teacher who spends a portion of her time with each student she is assigned to visit. By implication, the educational procedure will be varied depending upon the academic background of the student; e.g., if the visited student had previously been enrolled in a "regular" school and is now homebound due to a prolonged post-operative recovery, the emphasis will be upon keeping the student current so that he will not be unduly penalized for lost time upon his return to school.

The opposite alternative to a segregated environment for special education would be an integrated environment. An integrated situation is one in which the handicapped student is placed in the school he would normally attend. Without undue distinction, the handicapped student follows the "normal" educational procedure and interacts with his non-handicapped peers.

A corollary situation occurs when the handicapped student is educated in a partially integrated environment. Essentially this means that the handicapped student spends some part of his day in a "regular" school situation, interacting with his non-handicapped peers. The degree of integration will vary. Partially-integrated special education may be delivered in a self-contained classroom or in an itinerant classroom.

The self-contained classroom indicates a unit within a larger "regular" school which is devoted to children of a particular exceptionality. Being housed within a "normal" school affords the handicapped youngsters the opportunity of interacting with non-handicapped children in joint activities. Opportunities are also present for instruction which might not be as readily available in a segregated setting; an example is occupational education. The advantage often cited for the handicapped student is the preparation for living in contemporary society, with the opportunities for mingling with non-handicapped youngsters and the facilities provided for occupational training.

The resource room also is a unit within a larger "regular" school devoted to working with children of a particular exceptionality. Whereas a self-contained classroom connotes that most of the student's school day will be spent within it, the resource room implies the reverse. The student is excused from his usual classroom to receive special instruction. The special classroom is designated "resource room" because it is visited by the student, and perhaps by the teacher (who may also be itinerant because she visits several school buildings). The more common speech impairments are often treated in this way.

3.2 AT THE ORGANIZATION LEVEL

Quite often the options available for special education at the individual classroom and local school level are present because of flexibility at the next highest, or district, level. The term "organizational" rather than "district" level is used within this section to connote the flexibility beyond district boundaries that may be employed when providing special educational services. Due to the relatively minor incidence of handicapped youngsters, particularly of any one exceptionality, only the largest metropolitan districts may have a substantial handicapped population within their boundaries for whom to provide services. Obviously, not every handicapped youngster is so placed. It is in response to this widely-scattered user group that new organizational approaches have been forged. Prior to examining some of these options, it should be noted that the possibility always exists that smaller districts could provide tuition for their handicapped residents so that they may attend appropriate schools in other districts or states. Also, there usually exists the possibility of the appropriate state residential school.

Basically, new organizational approaches devolve from the idea of some form of expanded-district cooperation. Whether a more-encompassing special district is established or an agreement of cooperation is entered into, the core idea is to expand the population pool requiring special educational services. This accomplished, options for providing special education to a variety of user groups broaden.

While it is not implied that the following models were constructed solely to provide special education, "More schools have pooled resources for special education than for any other type of program,"[7] according to a Northwest Regional Educational Laboratory report, as cited in Shared Services and Cooperatives. While the quoted statement is perhaps referring to voluntary cooperation among districts, structures may be present in a state-wide system which could promote multi-district cooperation for special education.

Some states have established, while others are considering the establishment of, a middle-level echelon in the educational hierarchy. Lodged between the state educational agency and local educational agencies, this middle layer is variously termed either intermediate or regional. In addition to the varied nomenclature, these agencies may be variously empowered or constricted, again depending upon the legislation creating them. A U.S. Office of Education publication entitled "Educational Cooperatives" notes that middle-level units may not always correspond to existing political boundaries. The pupil population may range from a minimum of 10,000 to an optimum of 50 - 60,000. Generally, the ideal geographic size of any one middle-level unit is one in which the driving time from any point within the unit boundaries to a particular center established by the unit would not "exceed one hour for 90 percent of the area to be serviced." Other factors taken into account when establishing middle-level units include socio-economic considerations, existing facilities, and topographical qualities. As of 1966, 37 states had some form of middle-level educational echelon.[8] Specific references to special education provided in states through an intermediate educational unit have been noted for Michigan, (which allows its intermediate units to levy taxes for special education), Nebraska, Oregon, New York, and Iowa.[7,8]. This does not mean that those states exclusively provided special education to residents through intermediate units; rather that one service requested by districts within some of the middle units was that for special education.

School districts may voluntarily decide to pool resources to assure provision of services they would not have access to when operating singly. The distinction between this form of cooperation and the middle-level educational unit is that the latter is established by law, and membership may be mandatory. Both forms of cooperation may be designed to provide services requested by the member districts. As with a state middle-level unit, the geographic size and pupil population of a voluntary cooperative may vary. Since formation basically depends upon the willingness of individual school districts, the number of member districts and pupil population are a function of these variables. Generally, boundaries are drawn to include districts a maximum of an hour's drive from the central point of the cooperating area. When transportation facilities allow, a broader area may be taken in.[8] A frequently cited explanation for the many cooperatives created to provide special education is the relative scarcity of exceptional children in any one district; the guiding figure is that approximately 16% of any one district's school population will require education for the handicapped. Examples given of multi-district cooperation include Compton, California, and five northern Wyoming counties.[7]

Voluntary cooperatives may not only be established to furnish a viable special education district. There are examples of multi-district cooperation to provide screening procedures to identify the handicapped school population. Follow-up in such instances may not mean separate placement of the children, but suitable instructional resources and teacher in-service training to keep those children in the regular classroom with appropriate help. Inherent in the cooperative screening mechanism is the ability to retain the variety of specialized professional help necessary. Examples cited are from Keene, New Hampshire, and Olathe, Kansas, both described by Shared Services and Cooperatives as "small rural districts."[7]

A final model of expanded district cooperation for special education is represented by the St. Louis County Special District. Awarded the rare accolade of being unique in the nation, this example represents a school district that was originally legally created to exclusively serve the handicapped pupil population of the 25 suburban districts ringing St. Louis, Missouri. County-wide in scope, the District has many of the accoutrements of any other school district, including the ability to levy taxes and a publicly-elected school board.[9]

3.3 OUTSIDE OF SCHOOL

The delivery points for special education enumerated thus far, and the markets they serve, are all linked to the school system. However, other markets for this educational service exist, and these markets may be reached through other outlets.

A primary outside-of-school market is the parent. Although home and school cooperation may be close, there are other potential delivery points when addressing the parent of the handicapped child. Recall that very few handicapped preschoolers are served by public education facilities (section 2.2.1); therefore, alternative delivery points assume increasing importance.

Currently, it appears that many parents of handicapped children maintain contact with the special constituency group representing similarly handicapped children in their area. Examples would be the local association for particular diseases, or local groups concerned with a somewhat broader constituency (e.g., the Crippled Children's Society). Since many of these organizations provide additional services for the children, such as special summer camp programs, they may provide an important outside-of-school element in the lives of exceptional children and their families.

There are additional outside-of-school markets concerned with handicapped youngsters. Broadly speaking, these markets would include the many professionals who provide service to the handicapped youngster. They will be discussed in section 4.1.

4. SPECIAL FEATURES OF SPECIAL EDUCATION

4.1 THE PROFESSIONAL TEAM DELIVERING SERVICES TO HANDICAPPED STUDENTS

Although most children come into contact with adults acting in professional capacities during their childhood, the handicapped child experiences this to a greater extent. Not only are additional professional personnel necessary for providing special education, but specialized professionals are necessary when conducting screening programs to identify handicapped youngsters. All this is additional to the medical care required by handicapped students. For convenience in the ensuing discussion, the professional team will be divided into those providing the educational component and those providing the medical component.

The medical team, as used herein, encompasses those engaged in a medical profession and those providing related services. Generally, these people are involved in the identification, diagnosis, and treatment of the handicapped. This team may require the services of any, or all, of the following: pediatricians, particularly those specializing in neurology or psychiatry, physical therapists, occupational therapists, registered nurses, and audiologists. The list is not comprehensive, for a variety of sub-specialists may be employed dependent upon the situation.

The educational team, as used herein, encompasses those engaged in teaching or administrative capacities. Instructors may specialize in teaching individuals with any one of the handicapping conditions. Often an additional layer of professional administrative personnel are helpful to a functioning special education district; a designated director for special educational services and his staff may all be required for larger districts. Coordinators of educational services such as the work-study coordinator, may play an important role. The increasing importance of occupational training in special education makes the expertise of this individual, particularly when working in tandem with a vocational rehabilitation counselor, of great interest. Finally, there are those professional personnel who may be provided by the school system, but who could be placed in either category described here. These professionals would be the social worker and the psychologist.

Thus, a professional team provides many services to a handicapped child. Coordination of team members is in the interest of the child. However, this professional array of expertise may pose problems for suppliers of special education. Not only are such specialized services in short supply, but additional layers of administration and professional personnel become part of the supplier's budget. Whether the cost of such services are borne by a single district or an expanded district, it represents additional expenditures prorated over a relatively small user population. [7,9]

4.2 THE LABOR INTENSIVENESS OF SPECIAL EDUCATION

The administrative, medical, and paramedical labor intensiveness of special education has been detailed in the preceding section. Heavy professional input does not stop at those levels. Self-contained classrooms for special education operate with a smaller student-teacher ratio than does the "average" American classroom.

Estimates supplied by the BEH detail the student-teacher ratio for all exceptionalities as of October, 1971. Excluding those handicaps served in a resource room, the mentally retarded and the hard of hearing have the highest ratios with 11 students to every teacher. This proportion seems comparatively small, particularly when compared with the student-teacher ratio of 23.6:1 found on the average in a "regular" classroom during 1967.[41] However, the 11 to 1 ratio found in classrooms for the mentally retarded and hard of hearing is higher than that for the multihandicapped, the exceptionality with the smallest student-teacher ratio of 4 to 1. Other handicaps served in a self-contained classroom, and their student-teacher ratios, are: the orthopedically handicapped and other health impaired, 10 to 1; the emotionally disturbed, 9 to 1; the visually impaired, 6 to 1; the deaf, 5 to 1.[1]

Exceptionalities served by an itinerant teacher on a released time basis in a resource room have higher student-teacher ratios. The speech impaired have 82 students per teacher; the learning disabled have 13 students for every teacher.[1]

4.3 INSTRUCTIONAL DESIGN OF SPECIAL EDUCATION

Special educators are used to dealing with a widely-divergent student clientele within any one classroom. Instructional methods remain open to the individual teacher's interpretation, past training, and the operating philosophy of the school or district. Within these broad descriptive boundaries, certain points emerge on a general basis.

A portion of special education may involve the relearning of specific tasks and their eventual integration into the usual school environment. Another portion of special education may involve the achievement of routine academic procedures with particular reference to the specific characteristics of the learner. Yet another portion of special education may involve the conditioning of a particular learner to a pattern of behavior acceptable to the home and school situations.

Therefore, special education is ideally highly individualized. Learning sequences may have to be reconstructed to suit the individual learner. It may often be desirable to reconstruct via capsulated, discrete units of instruction; this would allow for differences in student background and attention span, and provide for immediate feedback regarding progress. The learning environment may have to be somewhat altered to avoid conflict with individual idiosyncracies and, hopefully, lead to remediation.

Due to both the nature of the student clientele and many of the instructional tasks, special educators may be used to describing learning goals in behavioral terms and constructing modules of instruction. Whether the special educator does this consciously with carefully annotated lesson plans, or on an informal basis, these qualities are amenable to educational technology as it is currently developing. The concept of individualized instruction, as evolving through developments in educational technology, would seem compatible with many of the methods and goals of special education. The possibilities inherent in computer-managed instruction and programmed instruction would appear to have great potential for special education.[10].

4.4 THE DESIRABILITY OF A VOCATIONAL/TECHNICAL EDUCATION COMPONENT

Educating the handicapped child has many facets, among them the preparation for suitable employment opportunities. Impetus to this trend has been given by the Vocational Education Amendments of 1968 which mandated that 10% of the federal monies distributed to the states for that purpose must be spent on handicapped pupils. Furthermore, state-wide cooperation among agencies involved in special education, vocational rehabilitation, or related services was required.[11]

Educable mental retardates will form the bulk of the handicapped student population for occupational education. These students may be trained for some of the skilled occupations. Hearing impaired, visually impaired, and orthopedically handicapped students may also be trained for the skilled occupations. Of course, this statement should be understood to depend upon the background and abilities of the individual student as evaluated by the appropriate personnel involved in providing the vocational component.

For instance, the orthopedically handicapped and those suffering from degenerative diseases may be especially suited for seated work, e.g., clerical and data processing tasks. This restriction may not include work with industrial tools that may be done while seated; however, the tools may have to be somewhat modified. Deaf workers may find their niche in "noisy" occupations which would prove distracting to the non-hearing impaired.[12] It should be noted that like other facets of special education, the vocational/technical component involves a professional team providing direct and related services to the individual student.

Individualization is a key word for this facet of special education. Modification of the vocational/technical curriculum again will depend upon the individual student and the evaluation of the appropriate personnel. Modification may take various forms, such as stress upon pre-vocational preparation, counseling, and follow-up, a slower rate of instruction, particular attention to lighting for the visually impaired, and avoidance of architectural barriers for the orthopedically handicapped.

As for "academic" special education, vocational/technical education for the handicapped may take place in a variety of settings. Instruction may occur in a technical high school, a classroom designated for such subjects in a secondary-level institution, or on the job. Special residential schools for specific handicapped students and institutions housing members of potential user groups are eligible to receive funds for occupational training under the 1968 Vocational Education Amendments.

The philosophical motivation behind the provision of suitable vocational/technical education for the handicapped is evident. Those nominally considered handicapped represent, with appropriate training, a valuable source for the national labor pool. Such individuals are entitled to every opportunity to lead a "normal" life within the total community. It might be said that, at its best, vocational/technical education for this student population is not motivated solely by altruism; rather by a deepening understanding of the mutual benefits that can accrue to both society and the individual.[11]

5. THE COSTS AND FINANCING OF SPECIAL EDUCATION

As with any other educational service, special education incurs costs and demands sources of financial support. Generally, the costs incurred are greater per capita than that for "regular" education, and the sources of support are more diverse.

5.1 ADDITIONAL COSTS INCURRED IN PROVIDING SPECIAL EDUCATION

The costs incurred in supplying special education have been partially detailed in preceding sections. Sections 4.1 and 4.2 have examined the personnel, most of them on the professional level, who should be retained at least on a consultancy basis. Classroom instructional personnel, who should have appropriate post-secondary training, serve smaller numbers of students than do their counterparts in elementary and secondary schools. This professional input is prorated over a small user population.

Costs do not stop there. Transportation may assume a disproportionately heavy cost for day schools. Since many special education students should not come to school unattended, and parent car pools may not be feasible or advisable, transportation may automatically be provided by the educational supplier. Although transportation is a normal adjunct to the operation of many school districts, many handicapped students are educated in expanded districts (section 3.2). The increased territory of an expanded district, and the relatively small numbers of handicapped students, could make transportation a more sizeable cost than it would normally be. Even when dealing with an individual district supplying special educational services, transportation costs may assume greater proportions since the students may not be closely situated to each other or to the designated educational center (or special classroom); therefore, scattered users are transported to a designated unit with imaginable effects on the transportation budget.

Special facilities and equipment constitute yet another additional cost factor for special education. Schools for the orthopedically handicapped may either have to be renovated or specially constructed to be free from architectural barriers; ramps and elevators would be used in place of stairways. The costs of renovation or construction could be considerable. Classrooms within "regular" public schools used for special education, and resource rooms, may have to be suitably refurbished.

Itinerant teachers serving the homebound student population in particular may assume expenses of varying proportions. The geographic proximity of the students and the caseload of the teachers will be the determining factors. In this case it may not only be the cost of transporting the teacher, but the hourly salary often expended for traveling time, that may inflate the cost of this service.

Such additional or increased cost factors for special education may defy a simple solution for their reduction. As long as special education is provided in public day school settings to a scattered and numerically small group, transportation will always be a cost factor. Complete reliance on residential settings may also prove expensive. The benefits of group interaction for most handicapped children are important, and elimination of a group educational environment is not seriously considered.

The cost in terms of professional personnel is another example of expenses which may be considered on-going. The individualization of special education stems not only from the technical applicability of instructional design, but also from the human input. Much expertise goes into the identification, evaluation, and preparation of the student so that he may be receptive to the close personal attention of his teacher. This is an integral part of the special education process as are small classes, which provide for a maximum of flexibility and individual attention. Cost savings may not be effectuated by reduction of instructional, administrative, or supportive personnel, but by the extension of their services to a broader coverage area.

5.2 SOURCES FOR FINANCING SPECIAL EDUCATION

For purposes of the following discussion, sources of support for special education will be divided into two categories: 1) support for special education offered in a school setting, and 2) support for the individual enabling him to acquire needed equipment, treatment, or supplementary funds.

5.2.1 Support for Schools Providing Special Education

Privately supported schools providing special education are supported largely through tuition payments. Although these schools may be the beneficiaries of charitable fund-raising efforts, it is generally assumed that tuition remains substantial. This may account for the prevalent use of publicly-provided special educational facilities.

Publicly-provided special education may be financed through a variety of sources; generally, support comes from public funds at either the local, state, or federal level.

Public special education is partially financed at the local level. When a particular school district maintains its own special services, part of the financial burden is borne by taxes that district is empowered to levy upon its constituents. Specialized services provided by cooperating districts may also be partially subsidized by local taxes, as contributed by participating school districts from their individual budgets. Instances have previously been cited (section 3.2) whereby special and intermediate districts are legally empowered to levy taxes for special education.

Special education is also financed through state aid to the individual units supplying it. Admittedly, it is difficult to generalize when speaking of 50 distinct sets of laws relating to this topic. However, according to Gearheart writing in Administration of Special Education, this general pattern of state support emerges. State aid is usually given under the aegis of stimulating the availability of specified educational services. Aid will be given to all districts, regardless of individual financial standing, if they are willing to use the money for the educational practices that are being promoted. State aid distributed under this mechanism is normally for the "excess cost" of this service, rather than total reimbursement.[9]

"Excess cost" is subject to a variety of interpretations. Generally, some portion of the personnel cost will be repaid, along with partial reimbursement for transportation and equipment expenditures. Obviously, differences occur in the amount of reimbursement; variations cited by Gearheart include 50-80% of salary for either classroom teachers, appropriate specialists, or administrative personnel, and 50-100% of the cost of special classroom equipment. Examples given of partially subsidized equipment indicate reusable items that are aids to individual students, such as braille material, hearing devices, and mobility aids.[9] Some states may provide total recompensation for innovative special education programs.

Gearheart notes that legislative allocations may not always correspond to the maximum reimbursements allowed under state law. Additionally, it should be noted that partial state subsidization of special education may be a means of insuring state-wide minimum standards. Pupils per classroom, qualifications of instructors and administrators, and financial feasibility of transportation and specialized equipment provided in this way may be construed as establishing not only the provision of special educational services, but also the guidelines for an acceptable standard. It may also provide a built-in safeguard so that programs will not be abused by misplacing students within them or hiring unqualified staffers.

Yet another source of support for special education is the federal government. As of this writing, such support has come in the form of categorical grants, often channeled through state departments of education. The principal sources of federal support are as follows:

> The Elementary and Secondary Education Act (ESEA), Title I (as amended by P.L. 89-313) Title III and Title IV.
>
> The Education of the Handicapped Act, Part B.
>
> The 1968 Amendments to the Vocational Education Act of 1963.
>
> (See Section 4.4).

With the exception of the 1968 Vocational Education Amendments, there is much overlap among programs initiated and supported through these legislative provisions. All laws cited extend eligibility to handicapped students enrolled in non-public schools. The first three laws are all, or variously, concerned with the initiation of novel programs for handicapped students, curriculum development, purchasing of equipment, inservice training for special educators, development of suitable instructional materials, provision of diagnostic and guidance services. The student age range covered in these bills ranges from pre-school through the secondary level. Agencies eligible to receive funds under these laws include state agencies other than those concerned specifically with special education yet which deliver a helpful service to the handicapped youngsters. Recipients are varied and have included state departments or institutions of welfare, health, mental health or hygiene; university - related agencies such as graduate schools of education and appropriate medical school institutes; and private institutions serving a handicapped group. The laws support the listed services in so far as they deliver necessary help to the handicapped child. [13,14,15]

The initial legislative impetus in federal funding for special education came with Title I of ESEA. Enacted in 1965, Title I as implemented regarding special education allowed state departments of education to strengthen their resources and provided advance payment to local suppliers for sanctioned strengthening of their efforts. In effect, Title I ESEA was an infusion of funds that could be used for special education; this did much to bolster efforts at the state and grassroots levels. In 1967, Title VI was added to the ESEA; Title VI assumed a more concentrated posture regarding federal funding for special education services.[9]

At the risk of overstatement, the legislation outlined represents but the tip of the iceberg. Coordination of interagency efforts can help to augment the funding pie. For instance, state vocational rehabilitation agencies can contribute funds for refurbishment and instructional equipment when vocational/technical education programs are offered to handicapped students.[11] There is additional legislation pertaining to education of the handicapped. The Handicapped Children Early Education Assistance Act was passed by Congress in the fall of 1968. The express purpose of this legislation, initially funded for FY '69 at $1 million, was to provide preschools and demonstration programs focusing exclusively on the very young exception child.[15] Additionally, there is federal support for Gallaudet College, a post-secondary institution for deaf students located in Washington, D.C., the Model Secondary School for the Deaf, the National Technical Institute for the Deaf, and the American Printing House for the Blind, all institutions serving a specifically defined handicapped constituency.[16]

The status of educational revenue sharing, in lieu of categorical grants, is in doubt as of this writing. The proposed FY '74 federal budget advocated educational revenue sharing as a new concept in disbursal mechanisms. Due to the intricacies of change on the federal level, educational revenue sharing is not operative for the 1973-74 school year; therefore, FY'74 federal allocations for special education are difficult to determine reflecting as they do suggested changes towards educational revenue sharing. The proposed budget indicates the same appropriations as for FY '73; $37,500,000 in federal funds for education of the handicapped and a projected $93,609,000 total authorization with actual spending to be $89,950,000, an allocation decrease of $23,931,000. Reported estimates for FY '73 are for $131,109,000 in authorized appropriations and $113,881,000 in actual spending. The federal budget as originally proposed also indicates decreased expenditures for the National Technical Institute for the Deaf, the Model Secondary School for the Deaf, and Gallaudet College while the American Printing House for the Blind would receive the same amount of funds that it did during FY '73. However, selective budgetary analysis may not indicate the actual course of the future; it is entirely possible that while total funding earmarked for special education may decline, certain aspects of that field may receive continued, or renewed emphasis. [16]

5.2.2 Support for the Handicapped Individual and His Family

Aid to handicapped individuals and their families is not completely channeled through an instructional setting. The handicapped population may receive services and necessary equipment from a variety of sources.

Services to handicapped children may be provided by a variety of state and federal agencies and programs. Public help is usually available at the local level. Many publicly-provided services have previously been enumerated (section 5.2.1); state health and welfare agencies, state vocational rehabilitation agencies, and federal assistance payments to handicapped individuals are apparent examples. Many programs of direct aid to the handicapped individual have a bearing upon his educational opportunities. The Library of Congress program of books for the physically handicapped and blind, and state vocational rehabilitation agency provision of necessary equipment and instructional aid when needed by handicapped individuals are two examples.[11,16] Private charitable organizations serving a particular handicapping or disease constituency are yet another source of equipment provision.

Although the handicapped child and his family are seemingly blanketed with resource opportunities, many of them apparently overlapping, this does not automatically confirm their utilization. This brief overview seems to indicate that material help provided directly to the individual is of a "conventional" nature, e. g., equipment currently in accepted use for individuals with particular disabilities. Examples are mobility aids for the orthopedically handicapped, hearing aids for the hearing impaired, and brailled and recorded books for the blind. Should large-scale electronic technology demand new and expensive devices to enable individual usage, the question may evolve into one of provision. Will any, or all, of the current sources for material help to the handicapped individual broaden their concept of aid to include cable television hookups, data terminals, and facsimile capabilities in the home?

6. CONSTRUCTS FOR DELIVERY OF SPECIAL EDUCATIONAL SERVICES TO A REGIONAL AND/OR NATIONAL AUDIENCE

Provision of aid to handicapped children comes from a patchwork of overlapping sources. When examining the prospects for using large-scale electronic technology to serve this audience, the question of a regional or national audience arises. Although large-scale electronic technology is theoretically most adept at reaching geographically scattered users, economic considerations demand thought regarding the possibilities of an expanded audience. Hence, attention must be paid to existing constructs that could aid in the creation of, and delivery to, an enlarged constituency. Although some of the organizations to be cited may serve more than one market, or interest group, development of this section was based upon the primary interest group served by each organization.

6.1 ORGANIZATIONS SERVING PROFESSIONAL SPECIAL EDUCATORS

As befitting a professional group with defined common interests, those engaged in special education have national organizations. The Council for Exceptional Children in Arlington, Virginia, is a focal point for special educators. In addition to their conventions and publications, the CEC also serves as the ERIC clearinghouse for materials relating to exceptional children. In that capacity the Council for Exceptional Children is part of a national network distributing microfiche of relevant documents to libraries across the nation. By distributing materials from many sources to many public outlets, the ERIC system and CEC provide access to an array of special education materials for professionals and lay readers. As part of the ERIC network, documents distributed by the Council are catalogued in the monthly ERIC listings and sent to participating libraries. Provision is also made for hardcover editions of all materials to be ordered on request.

The National Center on Educational Media and Materials for the Handicapped is funded by a contract from the Division of Educational Services, Bureau of Education for the Handicapped, and dates from June 1, 1972. Authorized under the Education of the Handicapped Act, the National Center is located at the Ohio State University and exists to provide a national network for the development and distribution of instructional materials for handicapped learners. The National Center is at the apex of existing networks of regionally-based centers charged with similar tasks for their regional or handicapped constituencies. Although the National Center is ultimately user oriented, i.e., the handicapped child himself, emphasis thus far by all the centers has centered on acquainting the special educator with relevant materials and delivering them to her. While still in the developmental stage,* the National Center finds itself with considerations common to any organization providing research, development, and delivery for education; namely, to maximize coverage by working with as much of the professional team as possible, resolution of the copyright situation, providing training procedures so that materials generated may be best used, and insuring the generation of adequate user feedback so that evaluation and necessary changes may be carried out.[17]

Two elements of the National Center merit separate consideration: 1) the existing network upon which it is built, and 2) the delivery component.

The existing outlets comprising the network for the National Center include Special Educational Instructional Materials Centers,(serving handicapped students with most impairments), Regional Media Centers for the Deaf, the Educational Media Distribution Center, the Model Secondary School for the Deaf, the Kendall Demonstration Elementary School (also for the deaf), the American Printing House for the Blind, and the various state departments of education and affiliates of professional organizations. Figure 2 details the location of, and area served, by each of the Instructional Materials Centers and Regional Media Centers. The American Printing House for the Blind, located in Louisville, Kentucky, is the national reference center for instructional materials for the visually handicapped.

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* The National Center on Media and Materials for the Handicapped began a 15-month developmental year from June, 1972, to September, 1973. On September 1st of this year it began operation, henceforth functioning on a fiscal year from September 1 to August 31.

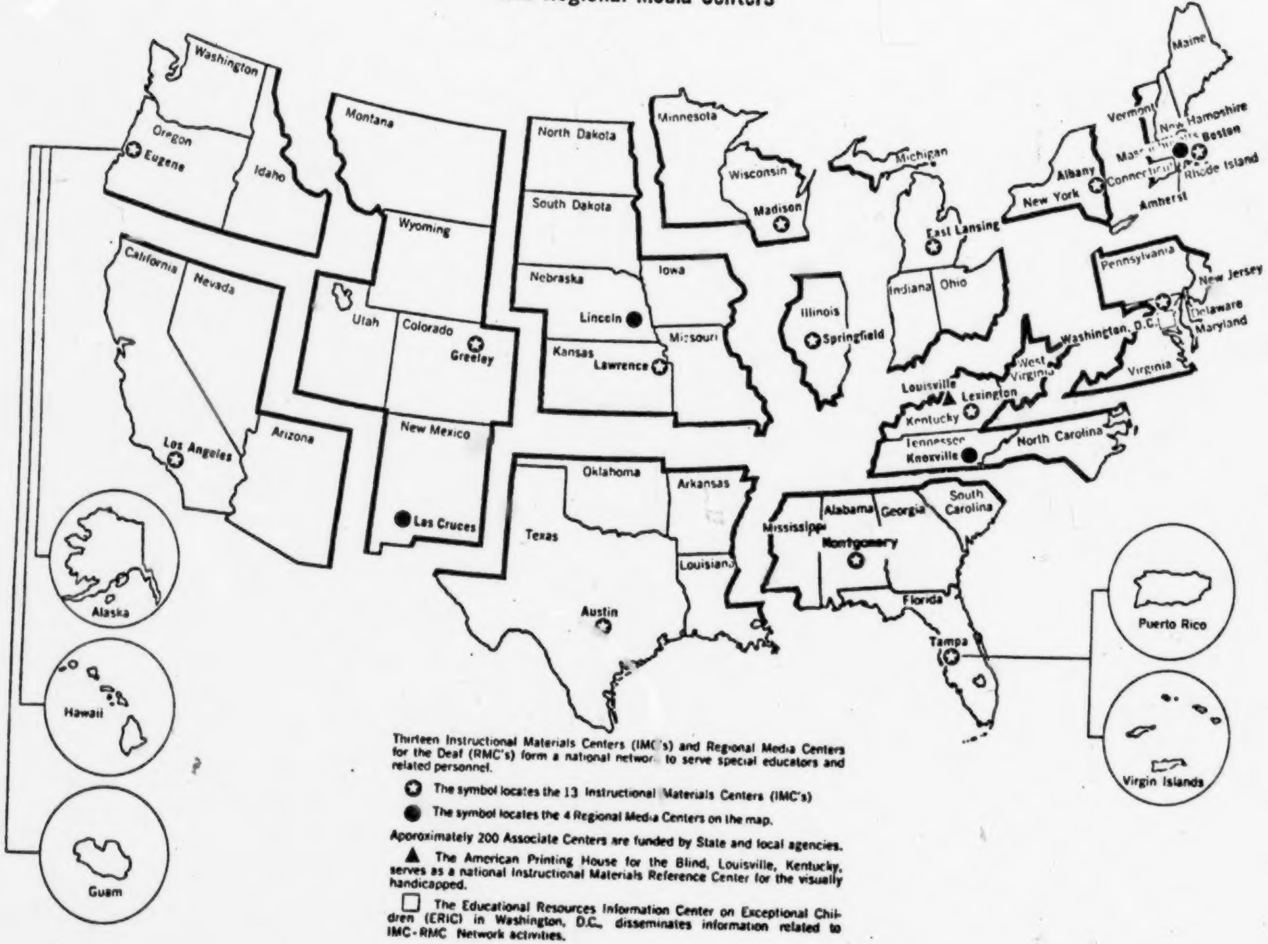
The functioning, decentralized network depicted in Figure 2 is supported by an additional 200 Associate Centers funded by state and local sources. Actual distribution to the user rests largely with the associate centers; contact between associate centers and the closest IMC or RMC is active. Not shown on the map is the Educational Media Distribution Center, located in Washington, D.C., which has a national constituency when providing captioned films for deaf viewers. Figure 2 does not indicate that the centers engage in more than dissemination; each is involved in research and development of appropriate materials.[15,17]

The network currently distributes by mailing requested materials. When the National Center begins to function as envisioned, new demands will be placed upon the distribution mechanism. Consideration will be given to cataloging, or the listing of relevant materials which may be found in a number of locations, i.e., in any of the materials centers, individual school libraries, or catalogues of commercial publishing houses. In order to make this plethora of information manageable, an interconnected information system would individualize feedback. The system would be designed so that inquiry would be in terms of individual needs and feedback selective according to input. Additionally, feedback would include identification of resource persons who could be contacted for aid when using the materials. Ideally, information requests and delivery requests could be handled at the same access time should the inquirer request. Thus, an individual teacher could request identification of appropriate materials for a specified learner, receive the information from anywhere in the nation, be notified of others who could aid her in using the materials, and request delivery of those materials should she deem them suitable! Furthermore, the system should carry feedback from the user to provide for necessary adjustments in the working network.[17]

Dr. John C. Belland, Director of the National Center, who provides a detailed description of the system in Audiovisual Instruction, cautions that the goals and operation of a national network are still in the earliest formative stages. Therefore, the actual design and capabilities of a working system have yet to be determined; the description relates the qualities most desired as of February, 1973. There are efforts underway that may be considered the preparatory spadework. The National Center intends to develop the capability to reproduce in most media a few copies of materials produced under federal contract as a means of insuring their availability. The need for a suitable information language is being approached by compiling concise descriptions of resources (both service and material) currently available. In addition, the National Center is using both internal and external staff to determine what remains to be done in order to establish the envisioned system.[17]

FIGURE 2

Network of Instructional Materials Centers and Regional Media Centers


Washington
Oregon
Eugene
Idaho
California
Nevada
Los Angeles
Arizona
Montana
Wyoming
Utah
Colorado
Greeley
New Mexico
Las Cruces
North Dakota
South Dakota
Nebraska
Lincoln
Kansas
Lawrence
Iowa
Missouri
Oklahoma
Texas
Austin
Arkansas
Louisiana
Minnesota
Wisconsin
Madison
Illinois
Springfield
Michigan
East Lansing
Indiana
Ohio
Louisville
Lexington
Kentucky
West Virginia
Tennessee
Knoxville
North Carolina
Mississippi
Alabama
Montgomery
Georgia
South Carolina
Florida
Tampa
Pennsylvania
New Jersey
Delaware
Maryland
Washington, D.C.
Virginia
New York
Albany
Vermont
New Hampshire
Maine
Massachusetts
Boston
Connecticut
Rhode Island
Amherst
Alaska
Hawaii
Guam
Puerto Rico
Virgin Islands

Thirteen Instructional Materials Centers (IMC's) and Regional Media Centers for the Deaf (RMC's) form a national network to serve special educators and related personnel.

✪ The symbol locates the 13 Instructional Materials Centers (IMC's)

● The symbol locates the 4 Regional Media Centers on the map.

Approximately 200 Associate Centers are funded by State and local agencies.

▲ The American Printing House for the Blind, Louisville, Kentucky, serves as a national Instructional Materials Reference Center for the visually handicapped.

☐ The Educational Resources Information Center on Exceptional Children (ERIC) in Washington, D.C., disseminates information related to IMC-RMC Network activities.

Source (as amended): National Advisory Committee on Handicapped Children, Second Annual Report, 1969, Better Education for Handicapped Children, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C.

Just as overlap occurs between the Council for Exceptional Children and the National Center on Media and Materials for the Handicapped (see Figure 2), the interconnection extends to yet another agency serving special educators. State departments of education have proven to be a steady pipeline to local educators. Personnel concentrating on special education interests within each state department have been pivotal in facilitating communication between local, state-wide, intrastate, or national interested parties.

6.2 ORGANIZATIONS SERVING FAMILIES OF HANDICAPPED CHILDREN

Special education in the schools fosters close cooperation between school and home. Attempts are made to involve the parents in classroom procedures to facilitate carry-over of behavioral and instructional methodology into the home environment. Therefore, the schools and any adjunct organizations serving them must be considered as conduits to the parents and families of handicapped youngsters.

However, the educational establishment is not the only means for reaching these families. The local affiliates of national organizations serving handicapped children and local agencies providing services affecting these youngsters are other routes. Examples of the former include local Muscular Dystrophy Associations; examples of the latter include Visiting Nurses Associations. Whatever the name used in each locality, these groups provide strong community ties to aid participation at the local level and the possibility for assembling audiences on expanded levels.

To date it appears that contact with these groups is largely dependent upon human contact. For instance, knowledge and consequent use of a Visiting Nurses program may primarily be a result of direct information from an informed neighbor, involved social worker, helpful pediatrician, or chance encounter with a promotional announcement via the media. Although this approach may leave many uninvolved, it does make these organizations very meaningful to those who participate. Thus, these groups may well bring with them the invaluable attribute of strong community ties and an interested constituency. They may well be the means for providing group viewing and follow-up procedures, should this approach be considered desirable in software design.

Additionally, there are other establishments offering possibilities for reaching the parents and families of handicapped youngsters. Hospitals, particularly large medical centers, may well now be offering classes for parents in home care as well as providing other services such as social work, continued therapy, etc. Here again the possibilities for assembling the desired audience with qualified staff supervision are present.

Finally, the expanded efforts of local organizations should be noted. For example, the John Tracy Clinic of Los Angeles, California, provides, as one of its many services to the hearing impaired child and his family, a correspondence course for parents of hearing impaired pre-schoolers. The lessons, prepared in both Spanish and English acquaint the parents with "...sense training, lipreading, language, auditory training and speech preparation" so that they may effectively work with their youngsters during the formative earliest years. As of late 1966, the correspondence course had had a total enrollment of "...more than 24,000 families in 98 countries" during its 23 years of existence.[18]

6.3 ORGANIZATIONS SERVING THE PROFESSIONAL "TEAM" PROVIDING SERVICES TO HANDICAPPED CHILDREN

Educators are not the only professionals with whom the handicapped youngster comes into contact. Section 4.1 has detailed the variety of professional personnel who provide services to the handicapped child. These professionals constitute yet another audience for information or material relating to the handicapped child. Members of their respective professional societies, the professional organizations serving this "team" provide a means of reaching local and expanded audiences with relevant presentations. Dissemination through these organizations may provide a group forum or outlets for meeting highly individualized requests.

Unlike many of the organizations referred to in the preceding section, these professional organizations may not be largely composed of individuals with highly similar interests. The American Pediatric Association has a membership that, as a collective body, has a high degree of interest in matters pertaining to handicapped children. However, within the parent body are individual members engaged in different medical specialties, some pertaining more directly than others to the handicapping conditions encompassed by special education. The interest inherent within each professional organization may well depend upon the proportion of its membership involved to some extent with handicapped children.

This situation may be in contrast to that of a local Muscular Dystrophy Association, in which membership interest may be well defined to that which pertains most directly to any phase of the life of a muscular dystrophy sufferer, perhaps to the virtual exclusion of anything else. Additionally, the material sought by a professional organization would differ in emphasis, and perhaps presentation, from that sought by a lay constituency group.

6.4 GETTING IN TOUCH WITH THE HANDICAPPED CHILDREN THEMSELVES

The reconstruction of the markets for information and material pertaining to handicapped youngsters that has dominated this chapter has not been compiled to ignore the children themselves. The inclusion of this section serves as a reminder that, just like other children, handicapped youngsters may be reached either at school or at home. Their parents may be closely associated with the school and related interest groups, but they too may be reached at home.

Two qualifications should be noted. First, that unless some form of person-to-person follow-up is coordinated with mediated instruction into the home, efforts may be received in isolation and consequently forgotten due to confusion or consternation. The format for software design cannot be mandated, but consideration should be given to the most productive instructional approach should direct-to-the-home delivery be attempted.

Second, although some electronic media are ubiquitous in American homes, not every medium is suitable for every handicapped child. Obvious examples are the unsuitability of conventional radio for the hearing impaired and conventional television for the visually impaired. While bordering on the cliche, one must not lose sight of the fact that although direct-to-the-home electronic instruction appears to be a means of blanket coverage, serious consideration of the suitability of each medium for the intended audience must constantly be kept in mind.

7. TECHNOLOGICAL DELIVERY OF, OR TECHNOLOGICAL AIDS IN DELIVERING SERVICES TO THE HANDICAPPED

What can large-scale electronic technology do for the handicapped student? If the medium is indeed the message, then each medium made possibly by electronic technology must be examined in terms of its intended audience.

7.1 THE DEAF AND HARD OF HEARING

Special education for the hearing impaired has the longest history of education for the handicapped in the United States. With the aid of refined medical treatment and technological advances, education of the deaf and hard of hearing has made formidable progress since its inception in 1817, when the first permanent school for the deaf was established in this country. [19] The advances and increased acceptability of this branch of special education should not belie the differences which currently envelop instruction of the hearing impaired.

The Bureau of Education for the Handicapped estimates that there was a total of 400,900 hearing impaired children between the ages of 0-19 as of 1969. Of this total, 348,600 were considered hard of hearing and the remaining 52,300 deaf. Hearing impaired of school age (5-19) were estimated at 301,000 hard of hearing and 45,300 deaf youngsters. [1] Clearly, hard of hearing youngsters are the vast majority of those considered hearing impaired.

The educator of the hearing impaired is dealing with a clientele of varying physiological capabilities, all of whom have difficulty hearing normal conversational tones. The hard of hearing generally have some residual hearing; the deaf may have less to the point of practically none. Another type of distinction that occurs among hearing impaired children is the extent of their linguistic abilities. Should a "normal" child lose his hearing at the age of eleven, he has had experience with oral communication and retains a language base. This capability diminishes the younger the child is when a hearing deficiency is noted or developed.

The linguistic capabilities the hearing impaired student brings with him to class have great implications for his further instruction. Schools exclusively for the deaf have experienced a change in the nature of their student bodies over the last generation. Prior to the 1940's and the widespread use of antibiotics and sulfa drugs in treating many childhood diseases, some children lost their hearing due to complications from measles, pneumonia, scarlet fever, mumps, and other childhood diseases. Before the 1940's, these children typically accounted for 50% of the enrollment in schools for the deaf. Since that time, more than 90% of the enrollment in these schools stem from children who were without hearing prior to language development. The educator is asked to develop language and speech in youngsters so that they may be instructed in the more traditional subjects. Understandably, developing a cognizance of language and oral communication demands a great deal of attention, particularly, during the pre-school and early-elementary years. [19] Although special educators for the deaf have been most conscientious in providing a traditional curriculum as the child progresses through school, it has been noted that studies reveal low-level reading achievement for deaf adults. Estimates indicate that the average deaf adult does not achieve at the fourth-grade reading level.

Basically, there are two methods of communication for the hearing impaired, and they correspond to instructional strategies. The "oral" method stresses lipreading and reliance on oral communication. "Signing" is manual communication wherein messages are conveyed through specified hand motions corresponding to letters, words, etc. "Signing," like any other language, may involve dialects, slang, or other localisms. [21] Sign language proceeds at about the same rate as spoken language, but lacks nuance and therefore presents difficulties in expression of abstract ideas. [12] Both methods may be used, and the mix is referred to as "total communication." [21] Some schools for the deaf rely more heavily on one method over the other; some schools use both. Whether there is a correlation between type and/or location of school and preference is not known.

A demographic portrait of the hearing impaired population is difficult to draw, largely because of differing definitions, hence resulting numbers, of the hard of hearing, and a paucity of recent statistical data. Using the criterion of manual language as the basic communication pattern, estimates have ranged from 200,000 to 300,000 Americans relying upon this mode of exchange. If one attempts to gauge the extent of hearing impairments in the general population, estimates range from 5 to 38 million Americans. However, demographic analyses indicate that greater numbers of the hearing impaired will be found in metropolitan areas. [12,20] As of a decade ago, regional hearing impairment prevalence rates were highest in the South, then the West, North Central, and Northwest. [20] Congregation of the hearing impaired, particularly the deaf, in metropolitan areas, aids their socialization and employment prospects. Dickson and Bowers report that many deaf individuals are semi-skilled or skilled workers, although they generally are not found in supervisory or white-collar capacities. [12]

Small-scale electronic technology has already done much for the hearing impaired individual. Continued refinements in hearing aids, most recently transistorized aids, have provided better amplification in non-cumbersome apparatus. This has allowed individuals to make better use of their residual hearing, and has helped outfit younger children who require proportionately smaller devices. Better hearing aids have facilitated the placement of hearing impaired students in "regular" classes (perhaps with resource room aid).

7.1.1 Large-Scale Electronic Technology and the Hearing Impaired

Large scale electronic technology has had a less helpful track record for the hearing impaired individual. Telephone, radio, television, and films (admittedly not an electronic medium, but for convenience classified in this way) have made media pervasive for most individuals. To the extent that these media (excluding radio) can be converted from heavy reliance on audio, they have application to the education of hearing impaired. Computer-aided instruction, exclusive of audio capabilities, is being used with some deaf student groups. Motion pictures, other than silent films, may be captioned.

The hearing impaired market for large-scale electronic technology should not be considered a monolithic whole. Dickson and Bowers, writting in The Video Telephone: A New Era in Telecommunications, note two communication patterns of the deaf sub-culture: 1) among themselves there is almost total reliance upon "signing", gestures, and "body language," while 2) between deaf and hearing individuals, most likely to occur on the job, communication will generally be written. Sub-culture members are futher defined as those profoundly deaf, perhaps lacking an oral language base, or those who move in circles where manual communications predominate. Thus, it is possible that individuals with varying degrees of hearing may share the life-style of the deaf sub-culture. Dickson and Bowers distinguish between this sub-culture and that of the hard of hearing, generally the post-pubescent hearing impaired, since an oral language base will have already been acquired and life styles molded around oral, rather than manual, communication patterns. [12]

7.1.2 Telephones for the Deaf and Profoundly Hard of Hearing

This sub-section is specifically entitled "...for the Deaf and Profoundly Hard of Hearing" to avoid confusion with the more generic term "hearing impaired." Distinctions among categories of hearing loss cannot rigidly be drawn within the context of this memorandum; however, the focus of this sub-section will be upon advancements in telephonic communications which should result in service to a specific group of non-users ---- individuals with the greatest hearing loss and smallest oral language pattern.

Although not the first large-scale electronic means of communication, telephony may be considered the first electronic medium to become pervasive at the individual unit level, such as homes, offices and mobile transportation facilities. It has become widely accepted that telephones are of little or no use to the deaf and severely hearing impaired population, a cruel irony in view of Alexander Graham Bell's motivation to aid them which led to his development of the telephone. Furthermore, it has been argued that the telephone may inhibit contact between the deaf and the general population by its omnipresence while imposing an impossible barrier for use by the profoundly hearing impaired with its exclusive audio capability. The opposing argument may also be presented; telephones have not denied communication between the hearing and the profoundly hearing impaired since such communication may well have remained on an inconsequential level with or without the telephone.

Nonetheless, Dickson and Bowers note that the telephone has hindered employment and advancement prospects for the deaf and constricted their independence by its very ubiquitiousness and their inability to use it. The constraints are less severe for those less effected by hearing loss; special instruments may amplify the audio signal to their needs, while those who lose hearing with advancing age have already established occupational contacts and predominately oral communication habits.

A possible solution to this dilemma lies in the visual telephone, which is now a reality. Video telephones have been produced by a number of manufacturers, among them the Bell System holding the major share of the United States telephone market. Now beyond the prototype stage, the Picturephone* is in limited service in Pittsburgh and Chicago. Currently serving a predominately commercial market, embryonic Picturephone* availability still represents the only example in the world of "...exchange video telephone service being offered by a telephone company." [12]

It is anticipated that the video telephone will aid the profoundly hearing impaired in two ways: 1) by expanding the telephone's capability to include visual as well as audio transmissions, and 2) by attaching devices to enable facsimile transmission of written, graphic, and digital material. The first capability, already operational, will allow those profoundly hearing impaired who communicate primarily manually to do just that over the telephone. The second capability, currently a potentiality, will allow written communication between the hearing and profoundly hearing impaired over the telephone. Visual transmission of the speakers themselves should extend residential telephone service to the profoundly hearing impaired. A form of the video telephone, the Vistaphone of the Stromberg-Carlson Corporation, has been tried at the campus of the National Technical Institute for the Deaf in Rochester, New York. The Vistaphone was used by hearing impaired faculty members as they would have used a telephone. Findings were that the deaf made use of the instrument, and that the visual quality was good enough for manual communications although lip reading would have been difficult for those who possessed the skill.

Facsimile potentialities are anticipated to enable deaf workers to fill positions now closed to them due to the inconvenience of relying heavily upon written communication with their hearing co-workers. Dickson and Bowers hypothesize that deaf workers could be attracted to information processing endeavors once the video telephone becomes operational with a full range of equipment including a keyboard and facsimile device. The fully-equipped video telephone of the future would be an information processing unit unto itself enabling the user to send and receive communications in the most convenient way, whether it be oral, visual, written, or graphic. The additional benefit of greater independence for the profoundly hearing impaired could accrue; it is expected that the greatest users of the video telephone for the foreseeable future will be commercial or service (e.g., physicians) interests. Access to visual telephony by the deaf will enable them to communicate directly with their doctor, employer, banker, etc., thus handling more of their day-to-day living details.

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*Picturephone is the trade mark of the Bell System. Unless a specific system is indicated, the generic term video telephone will be used throughout the section. For the phrase, as for most of the information and insight regarding video telephony, the author is indebted to The Video Telephone: A New Era in Telecommunications, a technology assessment prepared by Dickson and Bowers for the National Science Foundation.

Given the current and anticipated capabilities of the video telephone, it's ultimate usefullness to deaf individuals revolves around considerations of accessibility and feasibility.

Much of the foregoing discussion has been predicated on the assumption that the video telephone, like the audio telephone, will afford users random access to other users or services wired in to the network. Random access is expected to be a feature of video telephone service, but certain constraints are expected to exist. Video telephony is expected, for the foreseeable future, to primarily be a metropolitan phenomenon. Although inter-city service is anticipated, this should not impede access by the deaf to video telephony since the profoundly hearing impaired tend to congregate in metropolitan centers. Furthermore, the profoundly hearing impaired will most probably be the predominant residential users of the service for the foreseeable future; the expected user mix of deaf residences with commercial and service centers should provide adequate coverage for the needs of the profoundly hearing impaired individual.

Accessibility to the system then hinges on the issue of feasibility; how much will video telephone service cost, and will the expected figure lie within the purchasing power of the deaf individual? The estimated cost of video telephone service is partially explained by technological considerations of the system itself and partially by the market mechanism of anticipated public demand. Briefly, due to the increased bandwidth necessary to transmit a video telephone message and more expensive equipment*, video telephone service now costs $150.00 per month in Pittsburgh; this figure is considered the full rate, as opposed to a lesser, "promotional," rate in Chicago. It is safe to assume that a phone bill of $150.00 per month for "routine" residential service is beyond the means or desires of most Americans.

Dickson and Bowers estimate the cost to the government of both outright subsidization of visual telephones for deaf individuals and implementation encouragement through a tax rebate. Assuming 200,000 Americans rely primarily upon manual communications due to severe hearing loss, that many of these individuals intermarry thus reducing the number of households to be equipped while extending maximum coverage, and a rate of $150.00 per month for service, the figures are:

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*New switching apparatus would have to be installed by the telephone company to handle video telephone traffic which consumes a wider bandwidth; additionally, each unit would routinely be equipped with a television camera, monitor, and touchtone phone (touchtone is now optional). The future video telephone would include additional equipment to enable the transmission and reception of digital or written messages with facsimile options. Additional installations would not necessarily decrease per user fees, since the amount of wiring needed to insure random access would require relatively high capital costs per unit.

1) outright subsidization: $200 million per year; this represents a reduction of the $360 million per year that would be necessary to equip 200,000 people with video phones at the monthly rate of $150.00. The reduction results from the smaller number of deaf households due to the pattern of deaf intermarriage, and 2) "tax breaks" to encourage utilization by the deaf: $40 million each year would be lost as revenue by the government. This is figured at a tax rate of approximately 20% on revenues of $200 million should the deaf be allowed to deduct their costs for video telephones from their net income. Two corollaries should be mentioned: 1) some of the revenue loss should be offset by telephone company tax payments on their revenues, and 2) profoundly hearing impaired individuals would still be left with an annual phone bill of $1800.00, which would be an out-of-pocket cost. On the philosophical level, one may write of the costs and benefits that would accure to society as a whole should some form of subsidy be instituted to encourage video telephone service for deaf individuals. On the pragmatic level, Dickson and Bowers note that the dollar cost borne by society to aid the handicapped has never assumed such proportions.

Therefore, the issue of a "trade-off" arises; is it possible to use the same technological options at less cost to achieve the same goals? The potentialities envisioned for interactive cable television of the future are strikingly similar to those described for the video telephone. Both two-way CATV and the video phone may be complete information units: the capacity to transmit and receive digital, graphic, written or oral information is also anticipated for CATV. However, unlike the video telephone, two-way cable television lacks true access capabilities and, according to Dickson and Bowers, the economics of interactive CATV mitigate against two-way pictorial communication flow. Essentially for that reason the video telephone and two-way cable television were not seen as competing technologies, although both will have the potential to deliver programmed instruction and other interactive forms of graphic, written, digital, or oral educational information. Dickson and Bowers cite the "conventional belief" that video telephone service will be concentrated in the commercial and service sectors while interactive CATV usage will be concentrated in the home sector, thus splitting the aggregate market.

An itemized comparison between the two technologies indicates that capitalization required for two-way CATV service to an individual home is far less than that for both audio or video phone service. Capitalization costs equal $1200.00 per subscriber for local audio phone service, $4400.00 per installation for local video phone service (estimate), and $520.00 for the terminal equipment and wiring for two-way CATV plus $100.00 for the TV receiver. These capitalization costs are predicated upon installation in an urban setting of moderate population density. Capitalization costs for interactive CATV will vary with the population density of the service area, channel capacity of the system, percentage saturation of the market, and the "real estate" of the territory served; e.g., it is more costly to install an underground 24-channel CATV system in a dense central city than a similar system in a moderately populated residential area. Although some of these factors apply to the cost of telephone service as well, e.g. the property value of the territory crossed by the wiring, telephonic communication systems will still be more costly because of the random access afforded by the system. Unlike envisioned two-way CATV systems, where interactive communications would be restricted to the user and a selected remote head-end (i.e., data base, system request terminal), audio or video telephone systems would allow interactive communications between a user, any other user, or a selected remote head-end, at will. This feature, according to Dickson and Bowers, would largely account for the difference in cost between two-way CATV and telephone service.

The final consideration may become the ability of interactive CATV to serve the deaf home market as well as video telephony. It is anticipated that another feature lacking in two-way CATV will be two-way video, the capacity to transmit pictures from the home terminals to the reception spot. This capability would require a wider bandwidth, up costs, and is generally not considered worth it for the home uses anticipated for interactive CATV. However, it is the two-way picture flow of video telephony that is considered so attractive to the needs of severely hearing impaired users. Thus, the less expensive technology of interactive CATV would be able to provide written, graphic, or digital information for the deaf market, but be unable to deliver the ultimate feature of random access, two-way picture communications. The deaf home user's ability to communicate directly with his doctor, employer, or banker via two-way CATV would presumably be hampered by the lack of random access capabilities in the system and the possible lack of compatability between CATV systems.

Is the "trade-off" a stand off? Yes and no*. Technological advancements in information units have expanded the types of information that may be distributed among users. Insofar as written, digital, or graphic information may be disseminated at a "realistic" cost, the horizons of the severely hearing impaired have been expanded. If one may hazard a guess, the penetration of two-way CATV service in metropolitan settings may well include deaf households, since hearing children predominate in them and their desires may tip the balance of consideration in favor of installation. The extent to which deaf residents utilize the concommitant services of interactive CATV may be the extent, for the foreseeable future, of communication advancements in the daily life pattern and home education participation of the profoundly hearing impaired individual.

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*The conclusion is predicated upon the assumption that the total market for large-scale, interactive information technology will split between two-way cable television serving the home sector and video telephony serving the commercial and service sectors. It should be mentioned, however, that as of this writing, video telephones as they are now designed appear to be poorly accepted. Cable TV growth has also slowed somewhat, particularly in urban areas.

7.1.3 Computer-Aided Instruction for the Hearing Impaired

Computer-aided instruction (CAI) is yet another technology currently generating much interest for application to the needs of hearing-impaired students. CAI provides a means of individualized programmed instruction that is considered by some educators to be particularly ideal for compensatory and intense teaching situations. Since CAI may be implemented on a selected, but large-scale basis, specific user groups who may be geographically scattered have access to relevant programmed material emanating from a remote data terminal. Without an audio component, these qualities of CAI were considered applicable to the demands of teaching hearing-impaired students, both on an individual basis and as they constituted a dispersed, but identifiable user group.

The Institute for Mathematical Studies in the Social Sciences, at Stanford University in Palo Alto, California, has been awarded a grant from the Bureau of Education for the Handicapped to research, develop, and implement CAI curricula for hearing impaired students.* Begun in June, 1970, the original proposal was for a three and one-half year period to terminate in December, 1973. Operational by the 1970-71 school year, the project began with the participation of six educational units serving more than 1,000 hearing impaired students via 60 data terminals. Participation was expanded during the 1971-72 academic year to include two additional educational units while more terminals were added by some units already involved. The result was to expand operation to 88 terminals serving 2279 students. Participants varied along the lines of geographical location and day versus residential school setting. Residential facilities involved were the California School for the Deaf at Berkeley, the Kendall School for the Deaf and the Model Secondary School for the Deaf both in Washington, D. C., the Texas School for the Deaf at Austin, the Oklahoma School for the Deaf at Sulfur, and the Florida State School for the Deaf and the Blind at St. Augustine. School Districts conducting day classes for the hearing impaired who participated were the San Jose Unified School District in California, the Palo Alto Unified School District in California, and Texas County-Wide Day Schools with outlets in Houston, San Antonio, Dallas-Fort Worth, and Beaumont. The rapid expansion was made possible by a fund-stretching decision to share teletype terminals costs on an equal basis, the Institute and educational unit each paying half.

The Institute has developed numerous curricula for hearing students, most of which were felt to be applicable to the instruction of the hearing impaired. The three exceptions were those with an audio component, two of which were foreign language instruction, the remaining one for elementary reading. Of the eight curricula offered by the Institute to hearing impaired students, four were devoted to mathematics at some level, two were concerned with language, and two were for computer programming. The biggest enrollments during 1971-72 were for the Elementary Mathematics course and the Language Arts curriculum, registering 2146 and 1071 students, respectively. Participating students were from the secondary grades, and were felt to represent a cross-section of enrollment at that level. Degree of hearing impairment is such that admission to special classes has been allowed, generally described as a minimum hearing loss of 60 decibels in the better ear, although admission requirements will vary among the schools.

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*The following is based upon Reference 22.

Although students were presumably in their teens, the most-used CAI curricula presented material on a more elementary level. The heavily-enrolled Elementary Mathematics course offered work in fourteen concept areas ranging from equations to vertical addition; the range of concommitant grade levels was from first through seventh. The well-subscribed Language Arts course was tailored to fit the needs of its hearing impaired users. Although students were between 12 and 14 years old, the course emphasized standard English usage on an elementary level. Curriculum construction was partially based upon traditional approaches, e.g., a vocabulary list compiled from widely-used third grade readers, and partially reliant upon new approaches, e.g., suggestions of classroom teachers, and an inductive methodology. The goal was to increase the student's facility with written English. This course offering has spawned a study by curriculum planners to analyze writing samples produced by hearing impaired students so that the most appropriate software may be produced for their needs. Examples of the kinds of things scrutinized would be frequency of word use and idiomatic difficulties.

Aside from the prospects of CAI providing tutorial sessions, drill, individual ability pacing, and records of each student's performance, cost considerations were evaluated on the basis of such curricula being supplementary to the basic classroom instruction. Cost of this CAI system may roughly be considered the sum of the hardware component and the opportunity cost of implementing the mechanism; software and related labor costs are not specifically analyzed, prompting the inference that they are considered part of the package emanating from Stanford and thus covered by the government grant. Hardware essentially consists of the leased telephone lines used to tie in each terminal with the main data base at Stanford, the Palo Alto-based computer equipment, the individual teletype terminal at each outlet, and expenses accrued in running the individual outlet (e.g., supplies, proctoring). Itemized costs for the first three components are unavailable; however, equipment descriptions are as follows: interconnection between the core data terminal and student outlets are over regular phone lines, with one line able to handle 15 student terminals simultaneously, while greater numbers (up to 90 terminals accommodated with ease) are routed over "high speed data lines" also provided by the telephone company; the PDP-10 central processor with a capacity to store short-term information on eight disk modules accommodating 180 million bits each and long-term information on magnetic tape accommodating 280 million bits each; student terminals are KSR Model 33 teletypewriters devoid of all but written or digital capabilities, serviceable for one-tenth the cost of such fully-equipped outlets, yet able to send and receive information from the system core at approximately 10 characters per second.

Based upon "conservative" cost estimates and expectations that the price of some cost components will decline in the future, Institute planners figure a cost of $300.00 per month for each student terminal. This cost assumption is predicated upon a use frequency of 500 student sessions at each terminal per month, further assuming 20 school days per month of six hours duration with 25 student sessions each day. A daily session for Language Arts was for 10 minutes; each Math session ran about the same length. Thus, the aggregate cost figure becomes 60¢ per student session. Should daily use increase, cost-per-session would be lower. There is some indication that this may happen; the Institute notes that some residential facilities are currently using their terminals for 8 to 10 hours each day.

Opportunity cost is an economic concept dealing with what is known as a trade-off in the telecommunications vernacular. Specifically the opportunity cost of implementing a particular economic decision equals the cost of foregoing an alternate route, or the cost that would have resulted had another option been exercised. The index selected to measure the opportunity cost of CAI in classrooms for the hearing impaired is the student-teacher ratio, measured by itself and in comparison to the student-teacher ratio which results when CAI is instituted. The distinction between the two ratios results from the following reasoning: CAI will be implemented instead of lowering the student-teacher ratio. The funds that would most probably have gone for extending the staff will go towards CAI.

Working from an equation developed by Jamison, in which

$$S^{*} = S + \left[\frac{(S \times W \times (1 - R)) + (C(N) \times S^{2} \times R)}{W - (C(N) \times S \times R)}\right]$$

where S^{*} = student-teacher ratio after introduction of CAI

S = student-teacher ratio before introduction of CAI

W = the average annual salary of the instructional staff

R = the ratio of the post-CAI instructional cost per student to the pre-CAI cost.

$C(N)$ = the cost of providing a student N sessions of CAI per year

the opportunity cost was figured to require very slight increases in the student-teacher ratio. It is important to realize that calculations must be made for each instructional setting; for instance, staff salaries and student-teacher ratios will differ from day to residential, public to private schools. Additionally, "R" was treated numerically as "1", indicating no change in instructional cost per student when CAI is implemented. Tables IV and V present the data upon which opportunity cost calculations were made by Institute researchers. An additional assumption is that modest student-to-teacher increases would not be deleterious to the education of the hearing impaired.

TABLE IV

Salaries and Student-to-Staff Ratios in Schools for the Deaf for the 1968-69 School Year

Type of school	Average annual salary of instructional staff	Ratio of students to instructional staff
Public Res. Schools	$7564	5.6
Private Res. Schools	6251	4.9
Public Day Schools	8760	4.5
Private Day Schools	6009	4.5
Public Day Classes	7721	3.9
Private Day Classes	7740	4.4

Source: J. D. Fletcher et al, "Computer-Assisted Instruction for Deaf at Stanford University. Annual Report, "California Institute for Mathematical Studies in Social Science: Palo Alto, January, 1973. p. 65 in ERIC, ED 072 641.

TABLE V

Student-to-Staff Ratio Required to Leave Per-Student Instructional Costs Constant with Implementation of CAI[a]

Number of CAI sessions per year	Student-to-instructional-staff ratio
0	4.50
100	4.64
200	4.79
300	4.95
500	5.30
1000	6.50

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[a] The figures in this table assume a pre-CAI student-to-instructional-staff ratio of 4.5 and an average annual salary for the instructional staff of $8760. CAI is assumed to cost $.60 per 6 to 10 minute session.

Source: J. D. Fletcher et al, "Computer-Assisted Instruction for the Deaf at Stanford University. Annual Report, "California Institute for Mathematical Studies in Social Science: Palo Alto, January, 1973. p. 66 in ERIC, ED 072 641.

Writing in the project's annual report for the 1971-72 school year, Institute planners outline four approaches for operationalizing the system after 1973, when the BEH grant would terminate. Basically, these suggestions are variations on the theme of centralization versus decentralization of the system. The only outline of a decentralized system proposes dissemination of Stanford-prepared curricula via a series of nationally-scattered computer systems. Each system would have a central processing device serving from 8 to 16 student outlets. A system would not require a central operator, but could accomodate "relatively simple curriculum materials" for less cost than a more centralized system, bringing the monthly cost per terminal within the $166.00 to $300.00 range. These figures are based upon the assumption that expansion of the present Stanford-based system to 300 terminals would place the monthly per terminal cost between $250.00 to $400.00; furthermore, per-terminal costs in a decentralized system would be around two-thirds to three-fourths of those for a more centralized system. Per outlet cost reductions may be the result of shrinkage in the territory served by each system, thus cutting multiplexing and interconnection costs. A more detailed cost appraisal of this configuration is presented by Jamison et al, in "Estimated Costs of Computer-Aided Instruction for Compensatory Education in Urban Areas," which appeared in Educational Technology (1970). The detractions of a decentralized system are seen by Institute planners as lying within the curricular area; fewer curricula could be offered at one time, and feedback affecting curricular revision is impeded.

The three remaining approaches concern a centralized system; differences develop over the scope and administration of the envisioned network. Possibility #1 would be to maintain the system now emanating from Palo Alto, and expanding it to 300 student terminals serving 5 to 10 thousand hearing impaired students by the beginning of the 1973-74 school year. The total monthly cost for each student outlet was estimated to fall within the $250.00 to $300.00 range. Possibility #2 envisions the same system operated by a user group, e.g., the Kendall Demonstration Elementary School. Operational responsibilities would be complete with the sole exclusion of the core computer apparatus at Palo Alto. Possibility #3 would be the creation of a center devoted exclusively to running a CAI network for hearing-impaired students throughout the country. System capacity would be that "...of simultaneously running 500 to 1,500 terminals." Costs per student outlet are envisioned to fall between those for a decentralized system and those for an expansion of the existing system. Citing Ball and Jamison,* Institute planners note the economic attractiveness of using satellite interconnection for a CAI network for hearing-impaired students. Drawbacks to the third proposal center around the time lag which would transpire should a new center be created, and the concommitant administrative difficulties. Considerations favorable to any centralized system center around the relative ease of collecting feedback necessary to curriculum revision, and the wide-spread availability afforded appropriate software.

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*See Ball, J., and Jamison, D., "Communication Economics of Interaction for Dispersed Populations," Technical Report #190, Institute for Mathematical Studies in the Social Sciences, Stanford University, September 15, 1972.

Finally, when discussing CAI for hearing-impaired students, the ultimate question must be addressed: does this technology improve student performance? Students enrolled in the Elementary Mathematics course displayed improvement in computational ability and resulting grade level. Improvement occurred regardless of the student's initial ability level. Evaluation of the Language Arts curriculum was in terms of the program's internal validity rather than student performance. Investigative emphasis was upon "...how well the curriculum meets its objectives..." Further work will be conducted in curriculum design and optimum coordination between CAI language instruction and that in the classroom.[22]

7.1.4 Television for the Hearing Impaired

Making television more useful for the hearing impaired presents two possibilities. The first involves the use of captions; the second involves the device of a video insert in which an individual translates the audio portion into sign language. Television programs involving both modes have been aired over stations across the country. Statistics give indeterminate data regarding the preference, if any, for one method over the other. As of April, 1972, the Deafness Research and Training Center of the New York University School of Education noted that 47 television stations around the country programmed regularly scheduled news, public affairs, or entertainment shows with appropriate considerations for the hearing impaired. [20]

Television programming with accomodations for the hearing impaired may, like any other programming, originate at the local level, network level, or be syndicated (sold from market to market). The survey compiled by the Deafness Research and Training Center indicates activity on all three levels plus use of public access channels made available by cablecasters. Programming generally may be either standard fare with captions or "signing" to accomodate deaf viewers (e.g., news or "The French Chef"), or devoted to subjects primarily of interest to the hearing impaired (e.g., "The Deaf Community Hour" shown via cable outlets in New York City, featuring panel discussions and performances by the National Theatre of the Deaf).[20] Programming attempts to serve a variety of age groups; "Watch Your Child" and "Vision On" aim for the hearing impaired pre-school and child audiences, respectively. Both programs make use of "signing." [20,21,23] Interest in serving the deaf audience is evident from both commercial networks and stations and the Public Broadcasting Service and some of its local affiliates.

Since the deaf audience comprises a minor portion of the viewing public, the feasibility question arises regarding special interest programming for this group. The Deafness Research and Training Center reports that local time slots are readily given for prepared programming since such programming is considered a public service obligation of the station licensee. However, production of such "limited appeal" programming is often hampered by broadcast economics in which production costs are very high. The possibility that special interest programming for the hearing impaired may also appeal to a more general audience notwithstanding, the Deafness Research and Training Center has suggested the formation of a National Television Cooperative for Deaf Viewers. Essentially a consortium approach, the proposed National Cooperative would consist of members capable of producing the desired programming (either stations or agencies). Circulation of resulting programs would take place among the membership. In this way member broadcast outlets would have a pool of programming from which to draw while individual production expenses would be pared proportionately. It is anticipated that the functioning Cooperative would be self-supporting and operated in a flexible climate so that new formats and presentations could be devised. Currently the Public Television Library located in Bloomington, Indiana, and serving as the lending repository for much PBS and affiliated station programming, is able to supply a requesting PTV station with enough captioned material to last approximately one year if used at the rate of one-half hour per week. Programs available have a variety of formats. [42]

7.1.4.1 Captioned Television

The possibilities of captioned television have aroused recent interest. Although captions frequently appear on the home screen under certain circumstances, captioned TV for the hearing impaired implies a constant stream of captioning to transform the audio portion of the transmission into visual form. Technical questions arising include not only the optimum graphic presentation (legibility of captions, placement on the screen), but also the optionality of the arrangement, since a constant word stream may be distracting to most viewers.

The National Bureau of Standards has developed a method of transmitting captions which is technically operable and has good prospects for economic feasibility. Captions transmitted in this way would be "closed," e.g., received at the discretion of the viewer, as opposed to "open captions" received by the audience at large. The NBS method uses the vertical retrace interval, a portion of the video signal now used by broadcasters to transmit technical information unseen on the home screen. With the aid of either adaptors installed on sets at the factory or a separate decoding device attached to the home receiver plus equipment at the individual station and network level to transmit captions in electronic code, captioning is possible. Literature on the subject does not clearly outline the exact equipment which would be needed by broadcasters; if the captioning is open, an encoder for the captions would be needed. A device now available to broadcasters, the CBS Vidifont, sells for $35,000 - $40,000. The ingenious station interested in captioning but lacking such funds may caption by superimposing captions written on photographic slides over the video track. Additional cost to the broadcaster would lie in the personnel needed to compose the captions, whether they are open or closed. There is reason to assume that this would require specially trained manpower since knowledge of the "reading" audience would be indispensable to effective captioning. It is hoped that hardware costs to the consumer for the decoder would be less than that for a black and white receiver. Ultimate cost determinants will be: 1) the economic feasibility to the broadcaster of captioning most transmitted material, and 2) the consumer demand for captioning as evidenced by the market for decoders. [20,24,42]

The software component, or the captions themselves, should be considered. The caption producer is faced with two realizations: 1) different "sources" of TV material are routinely transmitted, each with its own captioning production problems, and 2) as previously noted, the deaf viewing public generally has a reading level below that of the fourth grade. The practical effect of these realizations is to make captioning somewhat less than a routine procedure. A television station or network routinely airs material that has been videotaped, filmed, or is being transmitted "live" from either the studio or a remote setting.[24] It is not unusual for a program to be a combination of material sources, as when a live newscaster leads in to a filmed report from a correspondent. There are technical difficulties which prevent closed captions being inserted over film. Videotaped and filmed material may be previewed for content to aid with caption composition. Many live programs are scripted, which would seemingly facilitate captioning, but many "remotes" may not be. At the current levels of technical and production expertise, captions are not viable for programmed material in "real time," i.e., there must be a time lag between original transmission and captioned version so that caption composition and insertion may take place. If a script may be obtained in advance of broadcast, then a captioned version may be run simultaneously with the original transmission. The overall effect may be confusing; there will be a few hours delay in running a captioned version of the national evening news, while President Nixon's inaugural address, available in advance, was carried concurrently in a captioned version.* In addition to these production considerations, captions must be constructed in accordance with the reading abilities of the deaf public. The captioner is trying to make a variety of material "readable" to an audience for whom standard English may not be the vernacular. Vocabulary, idiomatic peculiarities, nuance, and other linguistic elements must be taken into account along with the most appropriate reading rate for captions, optional size and placement of them, and other production considerations. Such problems have apparently been overcome, to some extent, by the Captioned Films office of the BEH which captions and distributes films for the deaf. However, its archives may be limited in comparison to the scope of providing captions for all, or most, televised programming in any one locality.

The concept of captioned television is widely considered to have merit, largely because it is expected to meet the needs of an underserved minority audience.** An idea whose time has come, field tests

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*As broadcast on station WGBH-TV Boston.

**Other potential beneficiaries of captioned television might be senior citizens who have lost their hearing with age and viewers for whom English is a foreign language, captions affording them another means of improving their English language skills.

of captioned TV continue. For an eight-week period spanning August and September of 1972, WGBH-TV in Boston captioned segments of "The French Chef" which were made available to other public television stations. The Public Broadcasting Service will continue experimentation for 15 months under a $215,000 contract from the Department of Health, Education, and Welfare. Operating under a special FCC authorization, PBS will beam captioned programs to six member stations which will receive the shows on sets equipped with a decoding device. The stations, located in Washington, D. C., New York City, Los Angeles, Topeka, Kansas, Austin, Texas, and Portland, Oregon, will invite hearing impaired adults within their coverage area to come to the station and "view" the shows. The initial broadcast will be a captioned version of "Hollywood Television Theater" to be shown on January 2, 1974. During the course of the demonstration six other test sites will be added in Spokane, Washington, Jackson, Mississippi, St. Paul, Minnesota, Jacksonville, Florida, Denver, Colorado, and Hartford, Connecticut. Activity in these cities will begin upon delivery of decoders manufactured by the Hazeltine Corp. of Chicago. In all locations, adult programming representing a variety of formats will be screened by audiences representing different degrees of hearing impairments. Viewer reaction and system performance will be evaluated. The non-technical evaluation will be conducted by Galludet College which will issue a report, including long-term implications, at the conclusion of the field test. Additionally, Galludet will help participating stations identify and contact members of the target audience. [25,42]

Yet another potential audience for captioned television is the hearing-impaired school child in a special classroom. Captioned instructional television for these students may have viability if: 1) current instructional material can be suitably captioned without prohibitive cost, and 2) special classrooms could be furnished decoders without prohibitive cost when they become available on the market. Holding both issues in abeyance, the language requirements of captioning may assume greater importance when used for in-school educational purposes. Instructional material will be enhanced by precise conceptual and analytic language, which may or may not be adequately captionable. The alternative would appear to be creation of equivalent ITV programs for the deaf student audience, featuring a close fit with its school curricula. However, the economics of ITV may mitigate against this, although the Public Television Library and the proposed national Television Cooperative for Deaf Viewers may prove helpful. The potential of captioned ITV could be affected by work being conducted by Stanford researchers on the written language patterns of the deaf adolescent (see Section 7 1.3). Those hearing-impaired youngsters educated in a "regular" classroom would continue as they presumably do now, to view appropriate ITV programs without captions.

7.2 THE ORTHOPEDICALLLY HANDICAPPED, MULTIHANDICAPPED, AND OTHER HEALTH IMPAIRED

All of the handicapping conditions listed above present the possibility of restrained mobility. The individual's movements may be sharply circumscribed or confined to the home or bed. With the aid of wheelchairs, orthopedic braces, and prosthetic devices, this need not be the case. Yet large-scale electronic technology affords the possibility of extending the world of these people by bringing it into their homes.

Thus far, with the exception of the telephone, the electronic media have made the confined individual a passive participant. Conventional television and radio do not have two-way capabilities. Response capability is inherently potential in cable television, and a reality when dealing with computers. Penetration of both interactive cable and computers has been insignificant in the home setting. To that extent, the inherent potentialities of large-scale electronic media to serve the orthopedically handicapped, multihandicapped, and other health impaired seems visionary. With the possible exception of the orthopedically handicapped, the multihandicapped and other health impaired present a good potential market for the full array of instructional services in the home. Generally, this has been accomplished by the itinerant teacher, although telephone service to homebound students has been used.* The Bureau of Education for the Handicapped estimates that the national total of children with one of these three conditions was 389,500 as of 1969. Of this, an estimated 348,600 children between the ages of 0-19 were considered orthopedically handicapped and other health impaired; 40,900 children within the same age range were considered multihandicapped. The student population, those between the ages of 5-19, amounted to 301,800 orthopedically handicapped and other health impaired, and 35,800 multihandicapped. [1] The majority of students in this three-dimensional category are either orthopedically handicapped or other health impaired. The educational implications are that many orthopedically handicapped students are educated outside the home, and that other health impairments may in large part include recovery situations or conditions that can be corrected by protracted medical treatment. It is possible that a portion of students designated other health impaired may be homebound for varying periods of time, rather than during the entirety, of their school careers. Therefore, the actual market for long-range school services in the home may be smaller than these estimates would indicate.

Nonetheless, an experiment conducted by the Shawnee Mission/Overland Park, Kansas, School District during the summer of 1971 and the following school year has utilized the services provided by two-way cable to teach homebound students. The midwestern district lies in the eastern part of Kansas, covers an area of 70 square miles, and enrolls slightly less than 45,000 students in 65 elementary and secondary schools. Portions of the area within the school district are wired for cable reception.

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*Korman reports instances in Pontiac, Mich., Baltimore, Md., Los Angeles, and New York, among others. This service, called Tele-class, allows for interconnection of one teacher with a maximum of 20 homebound pupils. The instructor mans a central console fed by one regular phone line per pupil; at the teacher's discretion, student's may be connected with each other to create a classroom atmosphere. By using a head set and voice box attachment, the pupil keeps both hands free for instructional tasks. Needed materials will either be mailed or personally delivered to the homebound. Although the cost of this system will vary with location, selected cost figures cited by Korman indicate a savings over traditional teacher visits when using cost-per-instructional hour as the criterion. This results from the increased number of instructional hours afforded by Tele-class. Other cost components indicate a trade-off; expenses related to teacher visits (e.g., mileage) will be reduced, but technology costs will [presumably] be higher with the telephone system. [43]

The district is part of Kansas City suburbia and has a general population of approximately 250,000. Special educational services are provided within the district for residents. The school system maintains a district-wide capability of two, 24-hour open channels plus another channel divided so that one sub-channel may transmit to the homebound with another sub-channel handling return transmissions. The interactive component is via the cable head end.

The genesis of the homebound experiment was the desire of the cable distributor to test its prototype equipment for two-way capabilities and the opportunity offered by the schools when instructing the homebound students. The test situation linked two students homebound due to postoperative recouperation with each other and the teacher in the district's television studio. The students possessed normal intelligence, and instruction included the academic staples of the secondary curriculum. Although one of the students did have a speech problem, the technical reception allowed all three participants to understand each other. A simulated classroom environment prevailed. Equipment installed in the homes included initial cable hook-up*, a data set terminal, sub-channel converter, TV camera, and microphone. Full return capabilities for video, audio, and digital transmissions were provided by the cable distributor at no cost to either the school district or the individual families.

The outcome of the Shawnee Mission experiment in electronic teaching of the homebound was favorable for both cognitive and affective considerations.[26] The homebound student's learning gains were greater than what is usually achieved with an itinerant teacher-tutorial situation. The consensus of opinion was that increased learning gains stemmed from the "simulated classroom" established by the interactive capabilities. The teaching was handled by the instructor who normally was the district's itinerant teacher; while home visits were maintained, their number decreased as primary reliance was placed on electronic communication. Although the results were viewed as cheering and meriting further attention, the experiment had been discontinued due to financial difficulties of the equipment manufacturer and a lack of homebound students.** The school district has submitted a proposal for support to continue the experiment with an expanded case load.

Two questions remain unanswered by the Shawnee Mission experiment. The first concerns the optimum case load a teacher is able to handle using this equipment. The second involves data establishing the cost effectiveness of this method of educational delivery to the homebound. The Shawnee Mission/Overland Park Schools anticipate a cost savings by using electronic delivery of homebound education, but further utilization with an expanded student audience are necessary to prove the point. [26]

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*Participating students lived in neighborhoods wired for cable, although their parents had not previously installed the service.

**As of December, 1973, the situation was operational again.

As the experiment now stands, certain points should be reiterated. Participating students possessed normal intelligence, and their school work consisted of subjects as normally taught in "regular" classes. Although it is possible that some academic modifications had to be made due to the recouperative process, what was transmitted was conventional school room procedures. This has formed the backbone of much instructional television, as opposed to materials designed for a specific handicapped audience. The full array of equipment was provided without cost to the students, who happened to live in an area with a functioning cable system. The school district involved covers a broad geographic area without an unusually high population density. Should the experiment be continued and cost-effectiveness data generated, evaluation should be made with those factors in mind. Yet another parameter for analysing future data is the range of handicapped conditions served in this way. Should electronic delivery of special education be shown to be effective for confined students of differing conditions, the implications for all areas of special education may well be vast.

The multihandicapped may be considered severely physically disabled. Ability to operate the appliances used to provide interactive capability will undoubtedly vary with the individual. Some may be without speaking ability; others may not have control over their hands; yet others may have neither, so that the usefulness of conventional typewriters, data terminals, or microphones is doubtful.

The British firm of Possum Controls Ltd., has produced a system that allows severly disabled individuals to control approximately twelve household devices. Television, radio, typewriters, and telephones are some of the devices which may be controlled. Systems offered vary in complexity so that individual disabilities may be accomodated. Typewriter controls* allow for different typing rates; the slowest rate would allow for basic communication needs while the fastest rates, in excess of 40 words per minute, would enable the user to try for employment opportunities.

"Possum" is derived from Patient Operated Selector Mechanisms. Should the user have some control over his extremities, e.g., the fingers or the foot, the control system may be operated by switches placed within his reach. Should the user lack those abilities, control may be exerted by breathing into a tube which serves as the switch activator. The user maintains pressure until the indicator for the desired device is illuminated on the control panel. At that point the pressure is released, activating the specified applicane. The more complex typewriter systems may be pre-programmed wiht selected words or phrases; the user operates the system by activating switches according to a prearranged code.

Literature explaining the Possum system indicates that the British Department of Health and Social Security, and Employment will consider supplying the apparatus to qualifying individuals. The individual makes applications to the Department of Health and Social Security through his physician. [27]

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*Patent pending (as of May, 1972) in the United Kingdom and other countries. Other Possum apparatus patented.

7.3 THE MENTALLY RETARDED

The mentally retarded are the second most numerous group served by special education. The total mentally retarded population between the ages of 0-19 is estimated by the BEH as 1,697,500 as of the 1969 school year. Further estimates indicate 1,388,300 of these youngsters to be of school age. The BEH can account for 148,466 trainable mental retardates and 723,747 educable mental retardates actually served by special education programs during the 1971-72 school year. [1]

As stated in section 1.2.5, the educable mentally retarded and trainable mentally retarded present two distinct ability groups to the special educator. The educable mentally retarded (section 1.2.5.1), with an I.Q. range of 50 to 75, generally will learn at 1/2 to 3/4 the rate of a child of normal intelligence. The trainable mentally retarded (section 1.2.5.2), with an I.Q. range of 30 to 50, generally will learn at 1/3 to 1/2 the rate of a child of normal intelligence. It must not be forgotten that the ability to learn implies more than the cognitive; the individual's social and maturational rates will also be proportionately slowed. [30]

Educable mental retardates may master reading at a later chronological age than the non-retarded child. In the meantime, emphasis may be on other modes for the student to gain information, language skills, ability to discriminate, associate, and select appropriate learning clues. Educable mental retardates can learn through listening, particularly, and also through seeing (unless the visual element is too cluttered, thus becoming distracting). Therefore, there is an audio-visual element in education of the educable mentally retarded; audio-visual aids, graphic illustrations, audio tapes, films, and film strips are in use in these special classrooms. [10]

Lessons built around experience and classroom interaction may be valuable. With the retardate's limited attention span and natural inability to think in abstract terms, the instructional situation must be structured. Instructional goals designed in behavioral terms, structure partially accomplished by discrete learning units, all mark the methodology for dealing with the educable mentally retarded. [10]

This fact of instructional design has broad implications for the use of programmed instruction in the education of educable mental retardates. The goals of the educator and the capabilities of the methodology appear compatible. Computerization is, of course, one means of implementing programmed instruction in the classroom. However, special care may have to be given to the instructional program for it to be consistent with the student's limited reading ability. An option would appear to be emphasis upon graphic displays rather than words. Multiplace, a device requesting pencil mark responses to illustrated information, has recently been patented. The machine shows films to the individual student. His responses are recorded on a piece of notebook paper, placed over the rear face of a projector. The student is not requested to respond to the familiar question-and-answer format; rather he is told to respond when a particular illustration changes to another illustration. A signal records the student's response, and this record is stored for future analysis. Multiplace was created by Joan R. Forsdale in her capacity as media consultant for the Association for the Help of Retarded Children. The device has been used with non-retarded children and students with other handicapping conditions; Mrs. Forsdale reports that visually-impaired students possessing partial sight have improved responses to this approach over print. [28]

The instructional strategies for working with educable mentally retarded children augur well for large-scale electronic delivery with the stipulation that the software is suitable. Delayed ability to read and the possibility of constant inability to draw cues, inferences, and other abstractions from conventional print material make the choice of software of critical importance whatever the medium of delivery. Although programmed instruction may present the alluring potentialities of a supremely structured learning situation, it may not be the most important electronic element in the instruction of the educable mentally retarded.

Computer-managed instruction, with the flexibility it affords the instructor, may be equally meaningful for this branch of special education. The possibility of a large network which would provide resources amenable to individual students as characterized by their teachers, offer opportunities for the meaningful individual instruction desirable for educable mental retardates. This kind of network is envisioned by the National Center on Educational Media and Materials for the Handicapped (section 6.1). A "prototype" system is currently at work in the state of New York where teachers of the mentally retarded are encouraged to use Computer Based Resource Units for Special Education (CBRU). Provided by the New York State Network of Special Education Instructional Materials Centers, CBRU allows a teacher to have access to a variety of materials that may prove helpful for both class and individual student exercises. By completing a checklist of variables pertaining to group descriptors and individual descriptors, the instructor receives a print-out of materials (in many media), strategies, and evaluation of instruments for a number of instructional subjects. Aid may be enlisted for a number of instructional subjects. The teacher retains the right to use the material or not. Topic areas listed as being accessible after 1970 indicate that 8 to 28 units were modified for special education needs. One of the 8 was recommended for trainable mentally retarded students. [29]

Trainable mental retardates with their greater limitations demand different teaching strategies. Realistically, another set of outcomes would be the result of their education. Self-sufficiency, ability to handle basic human needs, an increased sense of socialization and cooperation would be suitable preparation for a probable life under continued supervision, whether at home, a sheltered environment, or an institution. However, this prognosis is made in the face of a dearth of research regarding this group and an apparent attempt in many classrooms to duplicate the academic preparation given the educable mental retardates. [31]

Although trainable retardates living at home will undoubtedly come into contact with the electronic media, their abilities to assimilate anything from the exposure should be explored. Without this definitive information, one must assume that the potentialities for utilizing large-scale electronic technology for the education of the trainable mentally retarded are unpromising.

7.4 THE EMOTIONALLY DISTURBED

The designation "emotionally disturbed" for a category of special education students may be subject to misinterpretation, perhaps more so than any other category. Misunderstanding may stem from the fact that traditional comprehension of a state of emotional disturbance implies some form of help other than education, e.g., psychiatric or psychological assistance, although emotional difficulties may often surface in the school environment. Indeed, classes for emotionally disturbed students are of recent vintage, treatment traditionally being administered in a setting removed from the school room.

Students places in special education for reasons of emotional disturbance may be considered as having behavioral or psychological difficulties of sufficient magnitude to prevent adjustment in the regular classroom environment. Conditions cited as indicative of this state are hyperactivity, aggressiveness, and withdrawal. Any explanation must be taken with the supreme qualification that students classified in this manner are exhibiting difficulties of some severity and recurrence. Although this entire categorization may be more a matter of diagnosis than any other special education category, presumably students so designated have had more than "a bad day." [32]

The Bureau for the Education of the Handicapped estimates a total of 1,388,000 emotionally disturbed children in the United States as of the 1969 school year; 1,207,200 of these children were estimated to be of school age. [1] In terms of total figures, the emotionally disturbed represent the third largest student population eligible for special education.

Essentially, a special classroom for emotionally disturbed children is a structured classroom in that the learning environment is not "open" to individual exploration or animation. The student is kept busy with academic work and classroom procedures and chores. Routine is established in accord with the student's attention span, need for immediate feedback regarding both work and behavior, and perpetuated in a climate of understanding the acceptable limits imposed by the classroom. The underlying principle is one of structuring the situation so that behavior is broken down and positive and negative feedback may immediately be given. The operant principle is similar to that of programmed instruction. Often the school may conduct sessions for the parents of these children, in an attempt to foster closer home-school cooperation, to keep the parents informed, and to aid the parents with their related problems in dealing with their children. [32]

While the role of large-scale electronic technology is essentially the same in this kind of learning environment as it would be in most any other classroom, there are specific applications of certain technologies that should be mentioned. Edwards and Judd comment upon the suitability of computer-aided instruction for the emotionally-disturbed student. The interface of disturbed youngster with the patient and persevering computer system is considered conducive to learning and temperamental stability. [33] The possibilities of computer-managed instruction aiding the teacher should be investigated further. Direction, policy, and parameters in a classroom for emotionally disturbed children come from the teacher. The instructor maintains constant involvement to monitor the progress of pupils and provide relevant feedback. In that sense, resource management and information provided for the teacher's aid by computer networks, similar to the CBRU (section 7.3), may provide a comprehensive interface with large-scale electronic technology for these classrooms.

7.5 THE VISUALLY IMPAIRED

Instruction for the visually impaired has a long history in the United States. As with any on-going field, the setting and philosophy behind education for the visually handicapped has gone through change. Just as the student population classified as hearing impaired has changed in nature over the years, the nature of the visually impaired student body has changed over time.

Students considered visually impaired may be either blind or partially sighted. Obviously, the difference is one of degree. Gradations in visual acuity involve ability to perceive light, ability to perceive gross forms, ability to distinguish colors, and ability to distinguish movement. Thus, an individual with poor sight that cannot be corrected to normal vision with aids may have some visual perception.

Educational programs may cite the legal definition of blindness; according to this standard, an individual is blind when his corrected vision is less than 20/200 in his best eye, or when he has an extremely narrow field of vision (less than 20 degrees). A 1961 study involving 97% of the students registered with the American Printing House for the Blind found that 42% of the youngsters considered legally blind were able to read print. The same study, by Jones and reported in Methods of Special Education, also found "a clear tendency...for local school students to read print while residential school students with the same degree of vision read braille." [34]

Educationally, there are two basic premises for understanding instruction of this student population. The first involves the distinction between the educationally blind and the educationally partially sighted. Educationally blind students use braille. Educationally partially sighted students read print. [34]

The second premise concerns the visually handicapped's ability to process information. This ability is intact although one sensory mode for acquiring information is admittedly impeded. Unlike the hearing impaired student, the visually handicapped student is able to acquire language and symbolic understanding; thus his internal mechanism for processing information is operant. Whereas much time and energy must be expended for the hearing impaired youngster to develop this ability, the visually handicapped youngster must be given every opportunity to develop maximal use of his remaining senses to aggrandize his information intake. In practical terms, this means mobility training and encouragement; recreational activities should not be ignored. [34]

According to Bureau of the Education for the Handicapped estimates reflecting the 1969 school year, there were 69,800 visually impaired children in the United States. 60,400 youngsters were aged 5-19, or of school age. [1] Estimated data does not indicate distinctions between those classified as blind and those classified as partially sighted. There is an indication that the "less handicapped" visually impaired students attend public day classes while the "more handicapped" students attend residential schools. Those students with the greatest academic potential, visual acuity, and the fewest adjustment problems tend to reside at home and attend day classes. The residential schools are finding their visually impaired student population increasingly composed of the multiply-handicapped, mentally retarded, or those with additional language or emotional problems. This placement tendency occurs in the face of continuing debate among special educators over the relative merits for the student of each setting. [34]

Medical complications that may leave the child visually impaired, possibly in conjunction with other handicapping conditions, may easily develop during the prenatal period. Bateman reports that prenatal influences account for nearly one-half of the blind (as opposed to the partially sighted) children. Outbreaks of rubella (German measels), often contracted by pregnant women, have occured periodically. Complications during the neonatal period, such as retrolental fibroplasia,* have traditionally caused severe visual difficulties in affected children. Hatfield's 1963 study of the causes of blindness, as reported in Methods of Special Education, revealed that approximately 75% of the blind children developed this condition prior to their first birthday. [34] Many of these children have some degree of residual vision making them educationally partially sighted. It is assumed that the designated partially sighted population exceeds the blind population.** Causative factors of partial sight may include those previously stated or other disease-based conditions, neurological impediments, or accidents.

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*Retrolental fibroplasia (RLF) has been found to result from an overconcentration of oxygen in incubators. Therefore, it is assumed that this cause of visual impairments may be substantially reduced. (Bateman, Methods of Special Education, p. 260)

**Bateman, writing in Methods of Special Education, cites "the usual estimate" of one per every 500 school children falling into this category, for an approximate total of 100,000 partially sighted school children. (p. 260) Mackie, writing in Special Education in the United States: Statistics 1948-1966, reports a 1966 estimate of 23,000 visually impaired special education students, of whom 14,000 were partially sighted.

Instruction of the visually impaired student population has traditionally utilized a variety of means to aid the youngster in acquiring information; realia, braille, or any other mode of kinesthetic or oral communication are two examples. Technological advances, such as tape recorders and radio, are used by visually impaired students and their aides, those who read to them.

Note should be taken of special radio services for the blind. Technological refinements, analogous to cable television and the myriad of programming to be offered by it, are being used in radio broadcasting to provide outlets for specizlized programming. Subsidiary Communications Authorization (SCA) uses a subchannel on an FM radio signal for special-interest broadcasting purposes. To receive such programming, specially-equipped sets are needed. Now there are instances of states using SCA bands on the FM frequencies regularly used for educational broadcasting to program exclusively for the blind. In Minnesota, cooperation between state educational radio and state services for the blind has produced 14 hours a day of "current affairs" programming for the blind received by 5,000 SCA sets in homes throughout the state. In Kansas, the state university radio station programs 7 days each week for blind Kansans using an SCA band. Programming is scheduled for 6 hours on Saturday and Sunday, 12 hours each weekday. SCA receivers number between 525-550, mostly situated in nursing homes and hospitals, with some in individual homes. The state of South Carolina and Michigan State University plan to begin similar services. [35]

7.5.1 Closed Circuit TV for the Visually Impaired

However, much educational material is transmitted by print, as is much material needed to hold a job or conduct a "normal" life. As explained by Genensky, visually impaired individuals may often need a means of keeping both hands free while reading to transfer material (read and write; read and type), or follow directions (read and draw; read and construct). This has obvious ramifications for the visually impaired student and for the independence of the visually impaired adult (ability to balance one's checkbook, file applications, etc.) [36]

New developments in closed-circuit television hold great potential in this critical area. Research into CCTV for the partially sighted has been carried out at the Delft University of Technology in the Netherlands, the University of Calgary in Canada, the Lawrence Livermore Laboratory in California, and the University of California, Berkeley. This list of research efforts is partial, and does not reflect that research has been in progress since 1959. The Rand Corporation of Santa Monica, California, has conducted a CCTV-for-the-partially sighted project since 1966. Since 1970, the primary funding source for this research was provided by the Social and Rehabilitation Service of the United States Department of Health, Education, and Welfare. The resultant device is Randsight, basically consisting of a TV camera, monitor, video information processor, and work area which allows the partially sighted individual to read printed materials or to write with regular writing instruments. [37] A modified device has been informally tested with 81 partially-sighted subjects for ease of use, reading ability, and writing ability.

Prior to a description of the apparatus developed by Rand, a clear definition of what such devices can and cannot do at this stage of development should be offered. Closed-circuit television for use by the partially sighted is an electro-optical system. As such, it relies on electronic as well as optical means to magnify and resolve visual images. The improvement over a purely optical system lies in the resolution capabilities and other refinements afforded by an electronic input. In that order, resolution qualities are improved and printed line isolation on the monitor is possible with an electronic component. Visual qualities of contrast and brightness are muted with a totally optical system due to refraction and light absorption. Electronic input heightens brightness and enhances contrast; the latter quality may be induced by reversed polarity on the monitor.* Electronic input may also provide an "electronic window" which presents selected visual material for viewing on the monitor, e.g., selected lines at a time of printed material.

The Rand system retains a limited mechanical component. Monitors and camera may be readjusted by means of motorized control. The camera may be lowered or raised, by means of a hand control, or repositioned for either vertical or horizontal movement, by means of either a hand or foot control. The monitors may be repositioned for height or distance by means of a hand control. Additionally, both camera and monitors may be rotated around axes to afford greater flexibility. [37]

Randsight, the CCTV system developed by the Rand Corporation, has undergone modification during its seven year existence. Changes may best be explained by referring to Randsight I, the original system, and Randsight II, the system prototype by 1972. The testing conducted with the 81 partially-sighted individuals was conducted on a Randsight I apparatus with a video information processor and X-Y work platform, two refinements incorporated into the Randsight II system. Therefore, testing results with the Randsight II prototype are not reported.

Figure 3 illustrates the Randsight II system. The user is seated at a regular desk supporting an overarching frame housing a television camera and two television monitors. With the electronic system components resting on the frame, the apparatus' reversed polarity capability shown on each monitor should be noted. Not shown in Figure 3 are two modifications of importance; the video information processor and the X-Y work platform.

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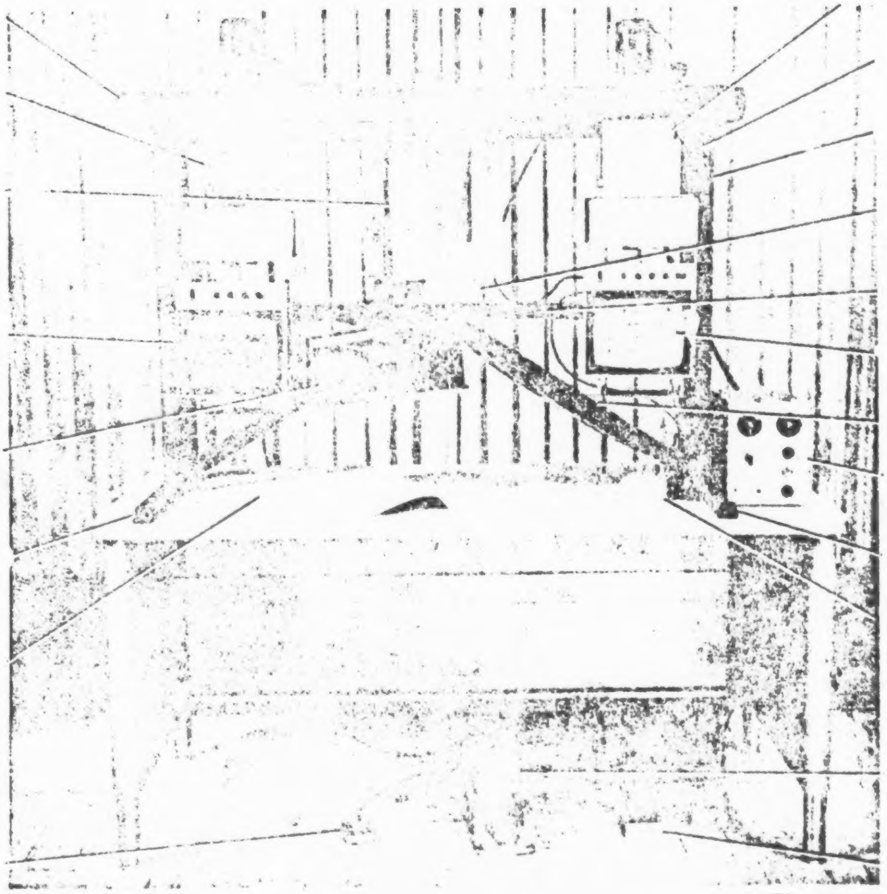
*Limited testing of Randsight indicates that more than 60% of the potential users prefer reversed polarity when working with the system.

FIGURE 3

RANDSIGHT II



Source: S. M. Genensky et al., Advances in Closed Circuit TV Systems for the Partially Sighted, Rand: Santa Monica, California, April, 1972. R-1040-HEW/RC

Figure 4 depicts an individual using the system. The user positions the paper under the camera overhanging the center of the desk. When the top left portion of the paper appears on the monitor, the user is ready to read or write. The paper is either read or written on line by line. The initial system featured a moving camera, operated by foot control, which tracked along each line and retracked to the beginning of the next line, while the user positioned the paper by moving it back at the same angle so that the left hand margin of the material reappeared on the monitor screen. A refinement of the procedure occured when an X-Y work platform was developed which allowed the camera to remain stationary while the paper was moved from left to right beneath it. The fixed camera permitted a cost reduction in the system's equipment of approximately 50%. The X-Y work platform rests atop a desk or table top. Essentially the platform, by means of a movable work surface, allows the user to move the paper in the same fashion previously accomplished by both the moving camera and the individual. In other words, in addition to moving the paper vertically and repeatedly aligning the left hand margin for each new line, the user now also moves the paper horizontally. This operation, which Rand researchers find to be easily mastered by partially sighted users, is done manually. It does not prohibit writing, the user merely sliding the paper along as he writes and then realigning for the next line. The dual monitor arrangement shown in Figure 4 allows both right-handed and left-handed individuals to use the system. The user merely relies on the monitor most convenient to his particular dexterity. [37] Finally, the Rand Corporation has conducted in-house investigations and consulted outside experts to determine the radiation danger, if any, that may arise from working in close proximity for protracted periods with this equipment. Concurring opinions are that radiation poses no danger to the unprotected user. [36,37]

To eliminate the problem of keeping one's place from line to line, particularly when maneuvering paper or printed matter, Randsight developers have produced a video information processor. This device is inserted in the cable between the camera and the monitor (and, therefore, is unseen in Figures 3 and 4). The video information processor may be used to create an "electronic window," or the effect of a blank monitor with only a line or a few lines visible at one time.

Another feature made possible by the VIP is adjustable height for the visible portion of the material on the monitor. Additionally, the VIP provides improved contrast and reversed polarity over what would usually be possible with monitor controls only.

Available with the Randsight system tested at Rand headquarters, the VIP was designed to be used with any camera and monitor incorported into similar CCTV apparatus used by the partially-sighted. Cost of the component parts is at the $35 level; this figure excludes labor, and the VIP may take electronic expertise to construct. Rand reports that they have been unable to interest electronic manufacturers in producing VIPs as part of their product line. [37]*

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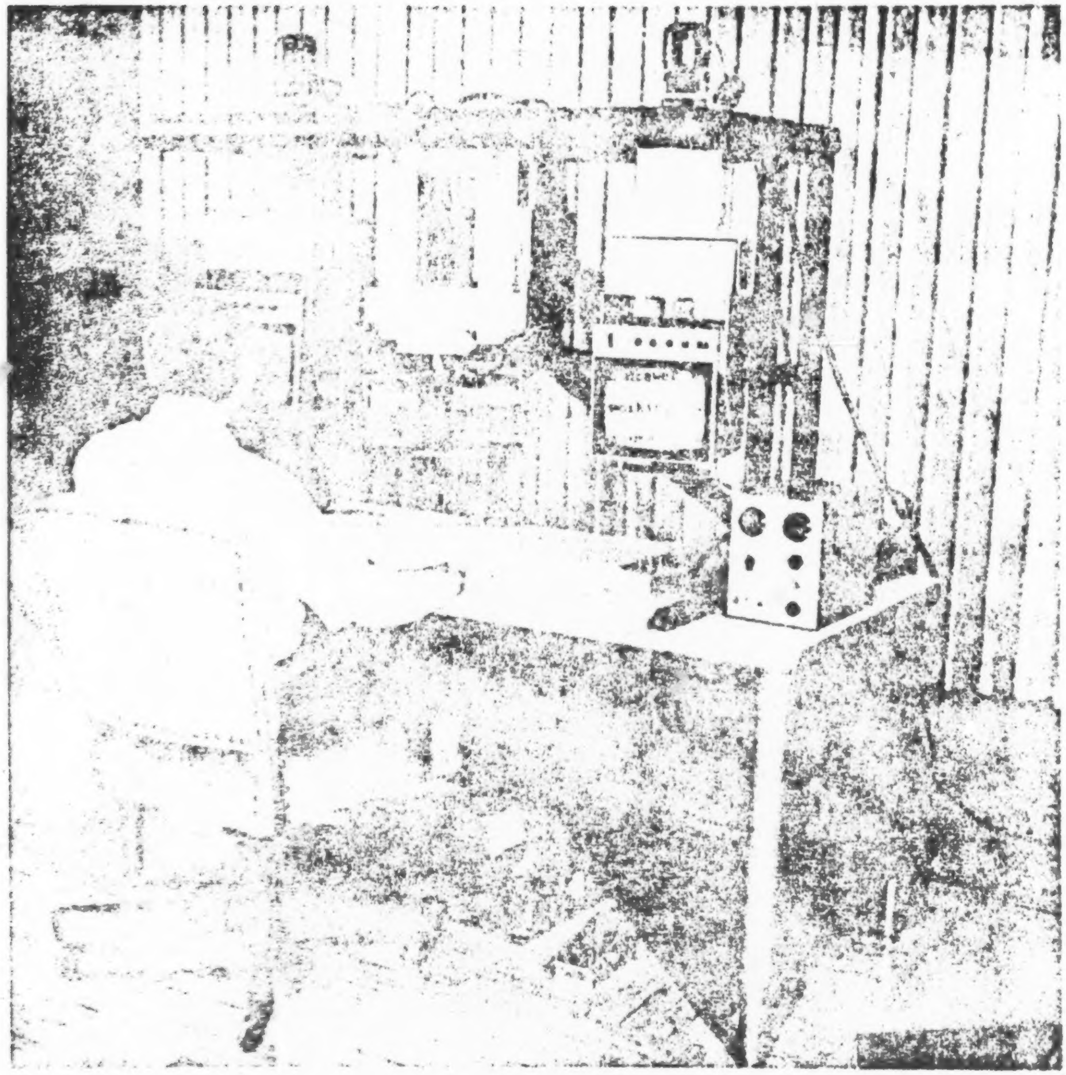
*More recent information is that the idea of manufacturing a total CCTV system for the visually impaired has caught on with some companies, and complete systems are now on the market.[49]

FIGURE 4

RANDSIGHT II IN USE



Source: S. M. Genensky, et al, Advances in Closed Circuit TV Systems for the Partially Sighted, Rand: Santa Monica, California, April, 1972. R-1040-HEW/RC.

Subsequent to an article appearing in the January, 1971 edition of The Reader's Digest on the Randsight System, approximately 120 visually impaired individuals contacted and visited Rand headquarters to gain first hand knowledge of the device. Of these visitors, some coming from as far as Chile and India, 81 were used to test Randsight regarding their reading and writing ability. The 81 were selected on the basis of the completeness of their biographical information, particularly their ocular history, and their lack of prior experience with a CCTV system. Tests of visual acuity were administered by Rand staffers prior to introduction to the system. Initially, the subject was taught to read. Various measurements were taken after the subject had read for five minutes. Figures recorded included the distance between the monitor and the working subject and the magnification selected by the subject. Ultimately, a words-per-minute figure was computed for the subject's oral reading rate. The procedure was essentially the same when the subject was next introduced to writing with the aid of the system.

The experimental population consisted of 59 men and 22 women. The age range was from 7 to 90; with the exception of the school-age group (7-19) with 7 individuals, the remaining participants were evenly divided between the older group (60 and over) and the middle group (20-59) with 37 subjects in each category. Ocular disorders represented were both disease and neurologically based. 79 of the participants had had their visual impairments for more than a year prior to their experience with Randsight.

Words read per minute were divided into three ranges: 1) in excess of 31 wpm, 2) between 2 and 30 wmp, and 3) a maximum of 2 wpm. Three distinctions were made when analysing writing: 1) the subject's writing was legible to himself, others, and was well spaced, 2) the subject's writing was legible to others at least, but was not well spaced, or 3) written product was scanty or illegible, so that definite conclusions could not be drawn.

Trial uses of 30 minutes each per subject produced the following results: 45 subjects read in excess of 31 words per minute, while 39 subjects produced suitably spaced writing samples legible to themselves and others. 67 subjects read a minimum of 2 words-per-minute, while 56 users were able to produce a writing sample of some legibility. Thus, a majority of those tested were able to read print and write with ordinary pens and pencils while using the Randsight system. Randsight developer Genensky reports that subjects initially reading in the 30+ words-per-minute category may reasonably expect to at least double their reading rate over time.

Ultimately, the worth of Randsight or any other CCTV system for the partially sighted will depend upon its amenability to the needs of its users. Particular considerations are the convenience of testing procedures designed to determine the system's suitability for an individual, and the appropriateness of a system for home, school, or office use.

Randsight system developers have devised a "lightbox" test for easy administration by any optical professional to determine if a visually impaired individual would be able to use a closed circuit TV system. A set of four typewritten transparencies, with variations in both the polarity and the typographical enlargement, are displayed in front of a lightbox such as those commonly used to illuminate X-rays for "reading." If the subject is able to read the transparencies, with or without corrective lenses, he is a promising prospect for using a CCTV system. The results of this test are not foolproof; however, it does give an indication of the subject's ability to read printed material as opposed to piecing words together letter by letter. In the latter case, Randsight developers indicate that the subject's reading speed would be so slow that improvement would not be appreciable with a CCTV apparatus. Selected subjects they have encountered, however, have not borne this out; the deciding factor may be the individual's motivation.[37]

Randsight, as described herein, is a stationary system, as are many of the other CCTV systems developed for the partially sighted. Indications are that two of the systems developed thus far may have some degree of portability. The system developed at the Livermore Laboratory features a hand-held TV camera which, with carrying case, weighs 28 pounds. The system developed at the University of California, Berkeley, features a TV camera, monitor, and work platform weighing 30 pounds. The system developed at the University of Calgary features a camera and monitor mounted on a wheeled desk so that the entire apparatus may be wheeled from room to room. The optimum classroom configuration remains to be determined. A 1970 Rand report detailing the then current state of development of Randsight spoke in terms of a fully-equipped classroom. [36] A master camera would be under the teacher's control while each student would have his own monitor, or each student would have both camera and monitor within reach. While this situation would be suitable for a self-contained special classroom, resource room, or a library, system portability must be considered when attempting to maintain the student's mobility...as is the case with visually-impaired post-secondary students.

7.6 THE LEARNING DISABLED

The handicapped student body designated as Learning Disabled represent a more difficult to identify group, both educationally and medically. Although variously linked to minimal brain dysfunction, thus implying a definitive physiological base for their difficulties, students falling into this category are often identified by an absence of definitive signs. Such students register a normal global I.Q. but are severely slow in acquiring some basic learning skills, e.g., in the case of the dyslexic an inability to read at the appropriate grade level. Although a continuing lag in reading skills may easily create problems of frustration, emotional disturbance may not mark the onset of the difficulty. A learning disabled student may not be identified by only studying his educational record; frequent changes in school, excessive truancy, or other indications of pedagogical causes may not be present.

Additionally, medical evidence may not be conclusive in identifying a causative factor. Sensory or neurological difficulties may be tested for; neurological signs may prove indeterminate; sensory deficits, if discovered, will not prove the corrective factor.

By process of elimination, the evaluation team is left with a child who, for no decisive physiological or pedagogical reason, displays normal composite intelligence while displaying disproportionate inability in some basic learning skill or related skills, e.g., the poor reading and spelling of the dyslexic.

By the nature of the identification process, special instruction for the learning disabled child is remedial in nature. Emphasis is upon teaching a basic skill to the student so that a foundation may be built and progress ensue. Whether progress will result in normal grade-level attainment will be discussed later.

October, 1971, Bureau of Education of the Handicapped estimates reflective of the 1969 school year indicate 697,300 learning disabled children, of whom 603,600 were of school age. [1] Statistical data from the same source notes that the predominent method of providing special education to the learning disabled is through released time from the regular classroom spent with a special, itinerant teacher in a resource room. [1] Therefore, the learning disabled student usually receives special instruction in much the same manner as the speech impaired child, both ultimately returning to the "regular" classroom for the bulk of their instruction.

The educational methodology for dealing with the learning disabled child will vary, depending upon the educational difficulties of the child. The predominant learning disability is dyslexia. The dyslexic student encounters serious reading problems; his reading will be slow, labored, and frought with errors. It will be below that of his peers as measured on standardized tests or in classroom performance. Related skills may suffer; penmanship and spelling will not be commensurate with grade-level or measured intelligence. Other possible manifestations include poor drawing ability or limited ability to record or work with numbers. Theoretically, all of these disabilities may be manifested jointly in any combination or singly. Usually, a dyslexic will have related spelling and/or writing problems. Should the dyslexic also be unable to record or process numbers, he may be evaluated as mentally retarded. A sole learning disability affecting computational capabilities, developmental dyscalculia, is unusual. [38] The point is, however, that the learning disabled student body is a heterogeneous one.

The learning disabilities described above involve a variety of physiological processes, many of a neurological order. Consider reading, a process most individuals are able to perform automatically. Reading, involves the recognition of graphic symbols as visual cues to be transformed into auditory stimuli; in other words, print is recognized as a visual representation of certain auditory sounds. The process procedes as the individual is asked to read aloud or to respond either in speech or writing to a question based upon printed material. In the first instance, the individual is producing a motor response; [38] in the second instance, the individual transforms a variety of cognitive processes into the motor response of appropriate speech or writing. The routine classroom procedure of reading silently or aloud and making appropriate responses as an indication of comprehension becomes an elaborate interface of processes when analysed from a neurophysiologic perspective.

Therefore, the proper approach to remediation for the learning disabled child may variously be considered a matter of controversy or diagnosis. Generally, the evaluation team is interested in finding the exact nature of the student's reading difficulties. Batteries of tests may be administered to determine the child's ability regarding memory, verbal reasoning, listening comprehension, and tendency towards word blindness and reversing letters, to name a few of the many factors taken into account. [39] Examples cited represent errors commonly made by dyslexics (e.g., the tendency to reverse letters in words) or contributing factors to the reading problem (e.g., poor memory).

Once the underlying difficulties have been identified, instructional policy comes to the fore. One may teach to the strengths, or the weaknesses, of the individual. The difficulties may be concentrated in the auditory or visual processes; phonics or word attack skills may be prescribed. Some approaches incorporate the kinesthetic modality; students trace and/or write letters, phonic combinations, words, etc., so that comprehension will be reinforced via the sense of touch.

Suitable instructional materials may pose a problem; if the child reads at grade levels below his chronological and mental age, commercially available materials designed for his reading level may not be of interest to him. Subjects providing the basis for instruction may be generated by student experience, teachers, or commercially available materials that are carefully selected. [38,39] Instructional programs based upon these principles would seem to require either small groups or tutorial situations so that student progress may be carefully monitored and the instructional approach be kept flexible.

The effectiveness of these approaches to the education of the learning disabled is a matter of some discussion. Hesitation stems from two considerations: 1) reading is a process which demands a level of developmental readiness; the student will mature at his own pace towards this level regardless of the practices employed to hasten the process, and 2) therefore perhaps the instructional methods are of less consequence for either remediation or rehabilitation, since poor readers may retain this educational deficiency into adulthood even when they have experienced special instruction.*

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*Both considerations stem from inferential evidence cited in two articles, "Adult Outcome of Disabled Child Readers," Herjanic and Penick, [47] and "An Evaluation of a Summer Remedial Reading Program," Weinberg, et al. [48] The Herjanic article notes that it is difficult to categorize the results of longitudinal studies on this subject due to incompatibility of research design and concommitant incompatibility of resultant evidence.

The fact that learning disabled students, particularly dyslexics, have engendered so much discussion within the educational, medical, and governmental communities* is indicative of the spotlight occupied by the problem reader. The proverbial product of American education, the student who cannot read, is a constant concern to a society which values literacy and fears the consequences, real or imagined, of this inability. An alternative perspective on the dyslexic and other learning disabled students would be to consider them "McLuhanesque" individuals. Currently citizens of the "global village" of aural, oral, tactile, and non-print modes of communication, the learning disabled may be experiencing disproportionate difficulties with the medium of print rather than the message contained therein. An intriguing possibility is that the learning disabled may be the prime target audience for the non-print educational prowess of the electronic media.

7.7 THE SPEECH IMPAIRED

Students considered speech impaired form the most numerous group eligible for special education. Children with speech impairments may be unencumbered with other handicapping conditions; they may lisp, stutter, have difficulty with particular letter sounds, have difficulty forming certain phonetic combinations, or generally have problems of articulation. Some of these difficulties are developmental in nature, and may be "outgrown" or overcome with appropriate attention. Sometimes corrective orthodontics may be helpful. However, some students with speech impairments may have them concommitant with other health conditions; speech problems commonly accompany mental retardation, brain damage, hearing problems, what is commonly known as cerebral palsy, cleft palate, and cleft lip. [40]

Bureau of Education for the Handicapped estimates reflective of the 1969 school population indicate a total of 2,440,500 speech impaired children. Of this total, 2,112,600 were estimated to be of school age. BEH estimates indicate that 1,360,203 speech impaired youngsters receive special instruction, marking this as the most populous handicapped category actually receiving special education. Generally speech instruction is offered in resource rooms visited by both teachers and students; teachers travel from school to school, and students are permitted to leave their regular classroom to receive speech instruction. [1]

The data cited does not break down the nature of the speech impaired student body regarding those students receiving instruction on a released time basis for a speech impediment and those students receiving instruction within a more segregated educational setting for handicapped youngsters. It will be assumed that the comparatively large student population of the speech impaired stems largely from those receiving instruction on a released time basis for relatively minor speech impediments. As such, the emphasis is upon concentration to overcome the impediment; students are taught the proper placement of the tongue, preferred formation of the lips, and other procedures considered necessary to the correction of the impediment. Drill is necessary to instill corrected speech habits in the students. Practice in proper speech procedure is accomplished by the speech exercises, drills, conversation between student and teacher, and during classroom exercises such as games, oral reading, or other activities considered suitable by the instructor. Instruction is given to small groups or individually.

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*See Weinberg, et al., "An Evalution of a Summer Remedial Reading Program," op cit, particularly pp. 494, 495.

Feedback to the student will be helpful. Whether the feedback is auditory, listening to the proper articulation as opposed to one's own pronunciation, visual, watching the proper way to form sounds and then practicing, or kinesthetic, touching the instructor's throat to feel the correct vibrations and then practicing, the student must gain concrete knowledge of the intangible phenomenon of speech. To the extent that tape recorders, recording devices in general, visual aids, whether elaborate such as a chromalyzer (machine visually displaying speech patterns) or simple such as mirrors, or any device is helpful in providing multisensory feedback, electronic technology may be of assistance to the speech impaired. The appropriateness of large-scale electronic technology for this kind of special instruction remains less well defined. Finally, the cost-effectiveness of any form of electronic technology in serving this area should be considered. The costs of elaborately equipping a resource room serving students with relatively minor speech impediments should be evaluated in terms of significant result when electronic aids are used. Multihandicapped children receiving speech therapy for more severe articulatory disorders may progress with electronic aids; however, these children may well be receiving speech instruction in more specialized settings where a panoply of equipment is already in evidence. Still, the cost-effectiveness and theraputic value of electronic aids should be monitored.

8. CONCLUSIONS REGARDING THE APPLICATION OF LARGE SCALE ELECTRONIC TECHNOLOGY TO SPECIAL EDUCATION

Special education is a kaleidoscopic field. An analysis of the prospects for utilizing large-scale electronic technology in this field must be reflective of its multifaceted dimensions. Available evidence indicates that special education in terms of selected learner populations may be a fertile field for the application of large-scale electronic technology. Much of the organizational frame work is currently in place, admittedly in embryonic form, for reaching all of the desired audiences and interested parties. Educational agencies have indicated a willingness to pool resources to provide special educational services to comparatively small learner populations. Broader potential applications of large-scale electronic technology lie along the avenue of extending the effective coverage area of evaluation teams composed of medical, paramedical, educational, social, and psychological personnel, most of them on the professional level and in short supply. Additional comprehensive applications are inherent in the potentialities of improved information transfer techniques; the accuracy of recording and the ease of dissemination regarding personal material would be of help to all those involved with the handicapped student and his files, provided necessary stipulations are maintained regarding individual privacy. Although beyond the scope of this memorandum, additional investigations may be considered regarding the application of large-scale electronic technology to the screening procedure for identifying handicapping conditions, and the application of small-scale electronic technology to aid individual operations for internal information processing.

Handicapped youngsters are certainly one of the most diffuse and diverse potential user groups for large-scale electronic technology. The extent to which electronic delivery of education and services may prove useful is the extent to which it can aid and promote the integration of the handicapped youngster into the total society. If large-scale electronic technology is able to expand the options for a handicapped youngster by providing a more meaningful educational experience or by bringing the child within the coverage area of the medical, paramedical, psychological, educational, and adjustment specialists needed to provide continuity of desired services, it will have aided the exceptional child in his preparation for adulthood.

It is difficult to write of the handicapped student population in total, whether using qualitative or quantitative terms. A variety of handicapping conditions are recognized by law as being eligible for special education; conditions so considered range from degenerative, physically crippling disabilities to neurological disorders that inhibit effective learning skills. The exact count of the handicapped student body has yet to be determined, although the Bureau of Education for the Handicapped has noted that "as of July 1, 1968, there were approximately 75,000,000 children in the United States between the age of 0-19 years of which an estimated 7,083,500 are handicapped.[1] Therefore, approximately 10% of the total under-19 age group is handicapped.

Although special education has experienced growth, increased public awareness, and greater funding input during the last generation, current estimates are that 43% of all handicapped youngsters nationally are reached by the appropriate program of special education. In 1948, the estimate was less than 15%.[44] Contrasts should be drawn with caution since the figures cannot be precisely compared for compatibility,* but the gain would seem impressive if insufficient. This in the face of an intervening generation in which special education has been the recipient of greater public impetus, although the student population considered handicapped has been expanded. There are two interpretations for this anomaly: 1) a good proportion of handicapped youngsters attend "regular" classes without distinction, and 2) the percentage-served figures are based upon estimates of the total handicapped student population; therefore, some of the population may be as yet undetected, and the low percentage represents problems in screening and other identifying procedures rather than the extension of special education programs. However, there do remain handicapped children unserved by special education for lack of an appropriate pedagogy rather than lack of identification. Autistic children, displaying communication and behavior problems of magnitude, have traditionally been excluded from public schools and many special education programs. A private school in St. Louis, Mo. is developing procedures to train both the autistic child and his parents in preparation for school entrance.[45]

Therefore, when examining the role for large-scale electronic technology in special education, consideration must be given to adjunct services which interface with actual instruction. Although medical and paramedical screening procedures, identification, and diagnosis are outside the scope of this memorandum, this entire area, as one of the many services accompanying special education should be further explored in terms of the role for large-scale electronic technology. Adjunct services provided by social workers and psychologists, variously supplied by the medical or educational agency, would also fall within the realm of further exploration. The point is that a valuable service may be rendered by expanding the coverage area of the evaluation team needed to identify the handicapped, or potentially handicapped, child. Many, if not most, of the members of the team are professional specialists, and as such may be in short supply. Large-scale electronic technology may be ideally suited to overcome the distance problem plaguing those who need help and those best able to help them. The evidence indicates a willingness on the part of many school districts to combine resources to provide special education or screening services. The organizational rubric may well be in place; further organizational and demonstration efforts to utilize technology to close the gap between working specialists and isolated populations may merit further exploration. Finally, it should be noted that within the educational effort itself there may be room for technological expansion of the coverage area of certain specialists. The desire for a greater occupational component in the special education process raises the issue of maximizing the input of vocational counselors. Currently it appears that complementary services are provided by some school districts and state vocational rehabilitation offices. Large-scale electronic technology may not only provide greater coordination between these two sources of expertise, but effectively expand the combined working area of specialists in each sector. Additionally, the linkage of all sources of vocational information and counseling may well be the key to pertinent job information from a multitude of sources.

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*For instance, the 1948 estimate represents data from 48 states. Compatibility of other baseline considerations cannot be accounted for.

A related matter to the technological expansion of the coverage area of the evaluation team is the issue of information transfer. Once identified, the handicapped youngster maintains contact with a variety of professionals who provide services to him. Contact among the individual, his parents, and team members is essential to the maintenance of service and the propriety of continued efforts. This would seem to present the classic case for optimal methods of information transfer, so that the youngster's file may be kept current and swiftly distributed to designated parties. The imminence of swift information transfer is dependent upon considerations bearing upon the broader matter of the information explosion as it affects the entire society; the issue will not be settled with respect to the handicapped population solely. However, the routing of the educational and medical files of the handicapped population would hopefully benefit from the improvement via large-scale electronic technology of information transfer techniques. Sufficient safeguards for privacy must be established and vigilantly maintained so that visionary optimism will not be marred by practical abuses.

The potential role for large-scale electronic technology in the actual instruction of handicapped students will depend upon the nature of the handicapping condition. Application of media disseminated in this way will not, in all probability, reduce the labor intensiveness of special education. Application of technology may not be a cost reduction for special education, although this remains a tentative formulation. However, in selected instances, large-scale electronic technology may provide improved educational methodologies for youngsters with a particular handicapping condition. Likely to be helped by technological input are the educable mentally retarded, visually impaired, orthopedically handicapped. It is doubtful that technological input would notably effect instruction for the speech impaired and the emotionally disturbed, although the latter may respond well to the patience provided by computer-assisted instruction. The video telephone, theoretically amenable to the disorders affecting both the speech and the hearing impaired, may not prove to be a practical solution due to its monthly expense and insignificant market penetration to date. The effects of technology for the hearing impaired must be considered indeterminate; captioned television, an exciting development, is currently in a developmental state for both hardware and software. The software input assumes increased importance when one considers the limited language base acquired by many deaf and hearing impaired individuals. Indeed, many of the media made possible by large-scale electronic technology are predicated upon a somewhat-developed verbal resevoir on the part of the user. This is not to totally discount educational technology for the hearing impaired; it is merely to state a real consideration that must be weighted when categorizing the potential application of technological input into their instruction. Perhaps an equally valuable avenue of continued inquiry is the application of technology, small-scale and large-scale, to individual information processing, e.g., aiding the individual to process information in the presence of a neurophysiological deficit.

The availability of suitable software, an issue oblique to the captioning difficulties previously mentioned, applies to the total concept of applying large-scale electronic technology to special education. In many instances, this may be a matter of careful selection of existent material; in other cases, modification or special creation may be involved. Overlap between material suitable for use by "regular" classes and that suitable for special classes apparently exists; it appears that when material must be specifically tailored for a very distinct learner group, available software is in less evidence.

Access to available materials and development of appropriate materials should improve due to networking structures now in existence and their expansion plans. The National Center on Educational Media and Materials for the Handicapped, incorporating the Special Educational Instructional Materials Centers and the Regional Media Centers for the Deaf among others, anticipates a development, accession, and distribution system linking material sources with instructors for optimal circulation of relevant materials. Tie-ins are currently operative between the various centers and state departments of education. Embryonic networks already exist in the form of assorted state and federal agencies, professional organizations, the clearinghouse for special education within the ERIC system, community organizations providing needed services, and the various constituency groups representing individuals and their families with the different disabling conditions. Improvements in large-scale electronic technology may aid in facilitating intercommunication among all interested parties; potentially, such improvements would hopefully aid the concerned individual in quick access to the appropriate source for help.

Although much of the hardware necessary for the improved capabilities envisioned is currently in place, or at least available on the market, many of the potential applications described herein assume eventual emplacement of hardware not currently so situated. Instruction of homebound students primarily via two-way interactive cable television, as experimented with in Shawnee Mission, Kansas, would seem an ideal application of fully-interactive capabilities in any one community. The current situation, and that for the immediate future, is not indicative of many communities with these capabilities. However, should cable television potentialities unfold in a fashion favorable to such capabilities, similar applications of home-school interaction may become commonplace.

Evidence cited indicates that most special education currently takes place in public day school settings. Particularly when the setting is one of partial integration of a special classroom within a "regular" school, much of the necessary hardware may already be in place. It is not uncommon for individual American schools to have television, radios, tape recorders, and other electronic gear for instructional purposes. In-house computers, particularly on the elementary level, are more uncommon, thus affecting the prospects for computer-assisted instruction.

The extent to which available hardware within both the home and the school must be expanded has yet to be precisely determined. Should extensive inputs be required in both settings to effectuate special education procedures, the question of financial resources becomes paramount. Many families undergo financial strain when supporting a handicapped youngster; many school districts strain available or pooled resources to provide special educational services. Additional, and possibly extensive, inputs may be financially unbearable for either party. The federal government extends financial aid to handicapped students, both in direct aid and through funding special education efforts. Handicapped constituency groups provide additional, if also circumscribed, support. Are both the government and the constituency groups potential sources for funding, should additional hardware become routinely necessary for optimal education and service to the handicapped youngster? Perhaps the ultimate answer rests upon a variety of factors, such as available funds vis a vis demonstrably necessary priorities and public support.

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